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Gateway's new panel fixes supersized LCDs' flaws

Next-Gen Optical Grows Up
The latest LG drive reads every format and writes Blu-ray!

Two Terabyte Drives Reviewed!
Tested: Seagate's and WD's massive new 1,000GB drives. Which one wins?

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AMD'S NEXT-GEN RADEON UNVEILED!

We sneak a peek at the RV670! Can it compete with Nvidia's best?

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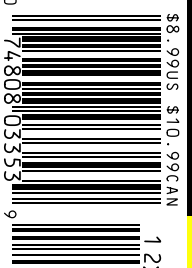

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Ed Word

Introducing Maximum PC's Mod Shop

Please send feedback and black-eyed peas to ***will@maximumpc.com.***

I'm taking a month off from my usual Vista grousing to share news about a special project we've been working on—*Maximum PC*'s Mod Shop (**www.modshop.net**). Whether you're a hardcore modder, a modding wannabe, or just someone who wants to learn more about the industrial arts of PC upgrading, The Mod Shop *must* become a regular pit stop during your travels through the Internets.

In simple terms, The Mod Shop gives custom rig builders and PC upgraders a big, bold, easy-to-use platform for showing off their projects. In The Mod Shop's pantheon of greatness you'll find amazingly detailed PC tributes to games, movies, and comic-book characters. You'll find paint jobs that belong in the Metropolitan Museum of Art. You'll find cooling schemes that will leave you awestruck and make you think about science. You can find them all at The Mod Shop, and you can even vote on your favorite projects as they battle rig-to-rig for serious cash prizes.

As regular readers know, *Maximum PC* has supported the modding community with frequent feature stories and our monthly Rig of the Month contest ever since the dawn of the PC modding scene. The artisans who create these rigs put in an incredible amount of work, and we love showing off their ingenuity and craftsmanship. Unfortunately, with just one page for Rig of the Month, we can never highlight as many machines as we'd like—thus The Mod Shop.

At The Mod Shop, anyone can post a rig profile, which can include pictures, a complete description, and even a work log to chronicle your step-by-step building process. As I write this, The Mod Shop is teeming with the work of expert modders, but it's also a place for all PC enthusiasts to post rig profiles—you don't have to be an egghead to represent! So please poke around the site and check out other people's rigs (you may even find some editors' rigs and Dream Machines in there!).

Besides posting a rig profile, we encourage you to actively engage in the site battles, which are the secret sauce of the site. Each month, we take the best rigs and pit them against each other in a series of head-to-head battles to determine the ultimate winner. The best part? You decide the winner of each and every battle by voting for your favorite rig. We've got more than $3,000 in cash and prizes to give away each month, and you decide who reigns supreme.

We've spent the last few months building the site; please check it out and let us know what you think.

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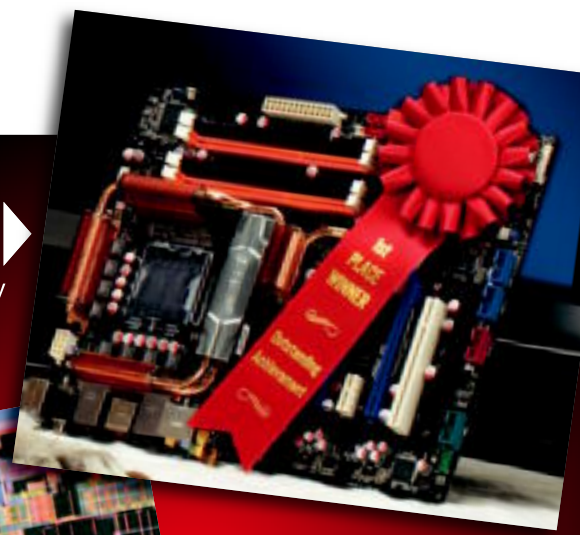

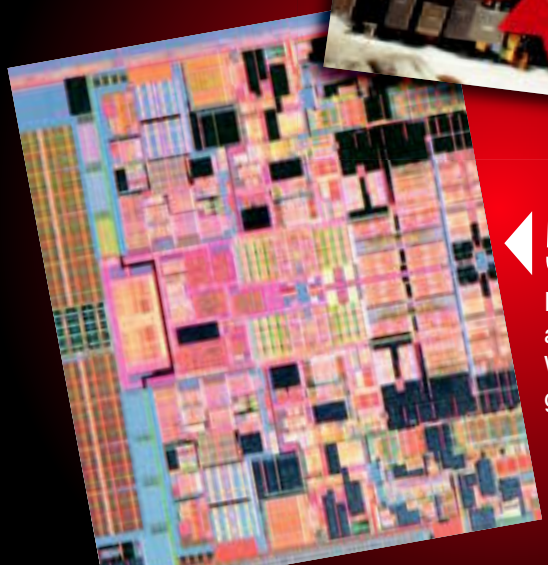

54 Penryn

Intel's new 45nm architecture is here. We'll take you on a guided tour.

MAXIMUM PC

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Future plc is a public company quoted on the London Stock Exchange (symbol: FUTR).

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Maximum PC ISSN: 1522-4279

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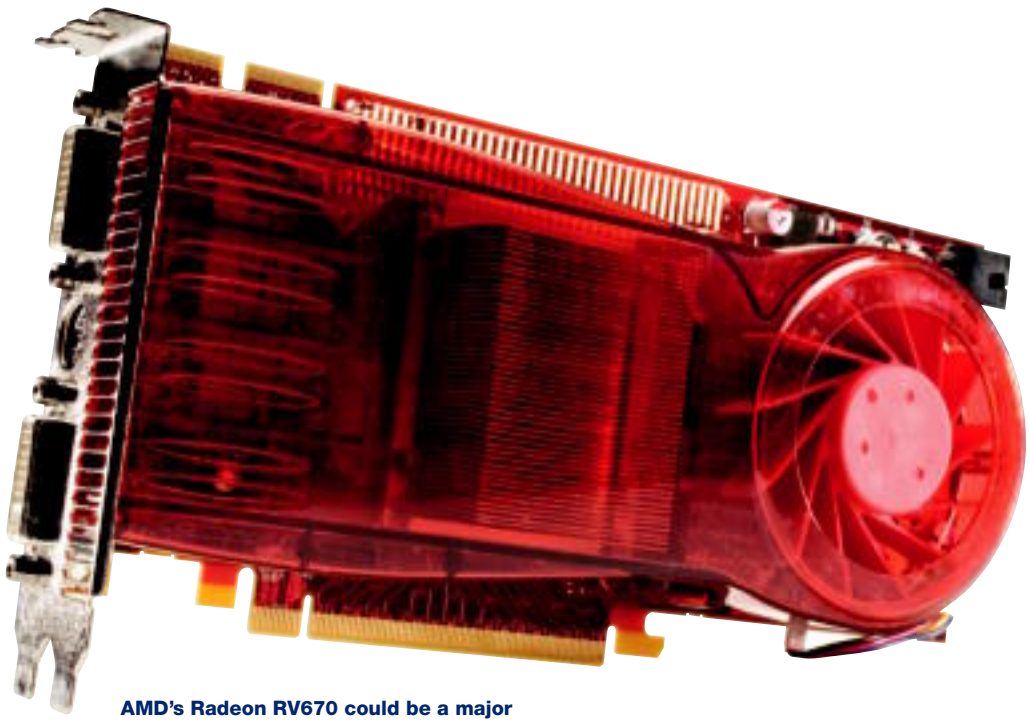
AMD's RV670 Rights Many Wrongs

Latest GPU draws less power; piles on new features



AMD's Radeon RV670 could be a major success—if it's clocked and priced right.

The good news for AMD is that its new GPU is a much better graphics processor than the absurdly power-thirsty Radeon HD 2900XT that thudded onto the market earlier this year. The bad news is that AMD still can't compete with either of Nvidia's high-end GPUs.

In fact, the prototype (and immature drivers) that AMD provided us for benchmarking proved to be quite a bit slower than an EVGA 8800 GTS using Nvidia's WHQL drivers. AMD told us it hadn't finalized the clock speeds for the reference-design card, and since Catalyst Overdrive had been stripped from the driver we were provided, we couldn't tell what clock speeds the prototype GPU and its 512MB of memory were running at. (PowerStrip revealed only idle clock speeds, which are ratcheted down when the GPU isn't under load.)

AMD hadn't settled on pricing or even a name for the RV670 before our print deadline (check MaximumPC.com for an update), but reps for the company did tell us there will be two versions of the new chip: An XT with 512MB of GDDR4 memory and a dual-slot cooler (the version we tested), and a Pro with 256MB of GDDR3 and a single-slot cooler. Both parts will have 320 stream processors, the same number in the 2900XT.

Both SKUs will support a host of new technologies, including PCI Express 2.0, DirectX 10.1, and Shader Model 4.1, and both will be equipped with AMD's Unified Video Decoder. UVD offloads all HD DVD and Blu-ray video-decoding chores from the host CPU. This feature is conspicuously missing from the company's top-end Radeon HD 2900XT (high-end Nvidia parts lack this hardware as well; you must step down to the 8600 GTS to get hardware decoding for HD). The new SKUs will also support HDCP on Dual-Link DVI so that 30-inch panels can display copy-protected high-definition video at their native resolutions. They'll also support VIVO for analog video editing (another feature Nvidia's hardware lacks).

The new parts will support triple- and quad-GPU configurations, provided you have a motherboard outfitted with AMD's upcoming 7-series chipset and either three or four PCI-Express slots (AMD has dubbed this ATI CrossFireX). AMD promises support for Intel chipsets, too.

Thanks to its 55nm manufacturing process, the RV670 draws considerably less power than its older cousin. Our prototype card had a single six-pin power connector and drew just 117 watts at idle and 208 watts under load, compared to the 2900XT's 175 watts at idle and an insane 318 watts under load. A lower power draw equals less heat dissipation, and that means AMD will be able to specify a much quieter cooler than the blow-dryer the 2900XT needs.

We'll reserve final judgment on the RV670 until we get a shipping product—and see what Nvidia has up its sleeve—but the new chip looks very promising from many different angles. And that's the best thing we've had to say about AMD's GPU efforts in some time.

BENCHMARKS

	SINGLE RV670 XT (512MB)	RV670 XT CROSSFIRE (512MB)	SINGLE EVGA 8800 GTS (320MB)
3DMARK06 GAME 1 (FPS)	**19.1**	39.9	18.9
3DMARK 06 GAME 2 (FPS)	17.1	33.9	**19.1**
QUAKE 4 (FPS)	73.9	130.3	**82.5**
FEAR (FPS)	46.0	84.0	**61.0**
SUPREME COMMANDER (FPS)	22.4	41.6	**26.1**

Best single-GPU scores are bolded. AMD-based cards tested with an Intel D975BX2 motherboard; Nvidia-based cards tested with an EVGA 680i SLI motherboard. Intel 2.93GHz Core 2 Extreme X6800 CPUs and 2GB of Corsair DDR RAM used in both scenarios.

Stiff Fine Levied for Copyright Infringement

The RIAA has finally caught a break. The first of its 20,000 peer-to-peer copyright infringement lawsuits to go to trial has resulted in a $222,000 judgment against Jammie Thomas, a Minnesota woman accused of distributing 24 copyrighted songs on the P2P service Kazaa.

The judgment is a dramatic turnaround for the RIAA. In recent months, its war on file-sharing has been dogged by universities and ISPs that refused to release individuals' account information and judges that quashed subpoenas and dismissed the recording industry's lawsuits.

The defense's argument—essentially, "you can't prove it was her"—was no match for the recording industry's strong case. Its lawyers noted that the IP address associated with the infringement was apparently used only by Thomas's password-protected computer and cable modem, and that the infringing Kazaa account name was identical to the name Thomas used for her other accounts.

Thomas plans to appeal the decision, citing a specific jury instruction which stated, in part, that making copyrighted files available on peer-to-peer networks violates copyright "regardless of whether actual distribution has been shown." Her defense argues that the Copyright Act doesn't say that and judges have handed down contradictory rulings on that topic in the past. Giving such an instruction to the jury obviated the need for the RIAA to prove that anyone but its investigators downloaded the files.

The win certainly adds bite to the RIAA's threats against file-sharers, but it remains to be seen how many of its other lawsuits will be as clear cut.

Vonage's Fate in the Balance

If VoIP provider Vonage can weather a spate of patent lawsuits, it just might survive. The company recently settled a federal court case with Sprint, agreeing to pay the telco $80 million for past and future use of its IP. Now it must resume a patent-infringement court battle with Verizon. The Federal Court of Appeals has already remanded a jury's $58 million-plus judgment against Vonage in that case; now the company is hoping a retrial in U.S. District Court will end the litigation once and for all.

P2P Paranoia Pays Off

Blocklists are essential if you don't want your peer-to-peer activity spied on by the Man. That's what researchers at the University of California, Riverside discovered after combing through 100GB of TCP header information from P2P networks. A blocklist contains the IP ranges associated with snoops for the RIAA, MPAA, and others interested in tracking file-swapping. The researchers found that users who failed to employ this useful device eventually connected to one of the suspect IP addresses, without fail.

Google Cashes YouTube Check

Google's purchase of the popular video-sharing site is starting to make sense—AdSense, that is. Google's highly profitable ad-serving program will now offer video units to its website affiliates. So an AdSense ad can contain site-related YouTube footage—framed by targeted ad text, of course. Revenue generated by clicks will be split among Google, the videomaker, and the website publisher.

TOM **HALFHILL**

Intel Thinks Different

By now you've probably heard about Intel's new QuickPath Interconnect, briefly known as the Common System Interface (CSI). QuickPath is Intel's answer to HyperTransport, the high-speed point-to-point serial interface that AMD adopted years ago. HyperTransport connects the processor core to the on-chip memory controller. On AMD's multicore chips, HyperTransport also connects the processor cores together.

Thanks partly to HyperTransport, AMD's processors have enjoyed advantages in memory performance, system integration, and power consumption. Now Intel is overcoming those advantages. New Intel microarchitectures like Nehalem are faster and more efficient, and QuickPath will match or exceed the performance of HyperTransport. QuickPath will appear in future Intel CPUs based on Nehalem.

However, QuickPath serves another purpose: It gives Intel an additional way to differentiate its x86 microprocessors from each other. These differences will be subtle but could measurably affect performance.

The oldest way to differentiate microprocessors within a product line is to offer them at various clock frequencies. All else being equal, higher speeds are better. Another differentiation that became common in the 1990s is to offer different-size caches. All else being equal, bigger caches are better.

More recently, yet another differentiation is to offer multiple processor cores. All else being equal—and assuming that multicore software is available—the more cores, the better. Ideally, those cores are integrated on a single die. Or multiple dies can be united in a single package.

Nehalem-based CPUs will differentiate in all those ways, but also in another: the configuration of their QuickPath connections. Consider the possibilities for a quad-core CPU. A lower-cost, lower-performance version could link the four cores together in a simple square. Each core could communicate with its two neighbors in one hop, but cores at opposite corners would require two hops.

Now picture a square configuration crossed with an "X" in the middle. These extra QuickPath connections would give each core a one-hop connection to every other core. This design is more expensive but delivers greater performance.

Of course, AMD can do the same with HyperTransport. The point is that future multicore chips will differentiate themselves by their interconnects, as well as by the usual factors. Two multicore CPUs with identical clock speeds, caches, cores, and integrated features may perform quite differently, depending on the arrangement of their internal pathways.

Tom Halfhill was formerly a senior editor for Byte magazine and is now an analyst for Microprocessor Report.

GAME THEORY

THOMAS MCDONALD

Hanging Out at the Quad Core

I've been gaming on a jury-rigged desktop frankencomputer for long enough to begin feeling those ol' tech-lag blues, so when VoodooPC offered to loan me an Envy H:171 gaming laptop, I jumped at the chance. Quad-core processing, complete with a 17-inch screen and a pair of GeForce 7950 GPUs, all at less than 12 lbs and portable? Sign me up, baby.

The first thing I did was fulfill a long-standing dream of mine to play PC games on my TV. (Hey, I dream small.) I only recently got a decent HDTV, and dismantling the desktop machine and hooking it up in the family room was never really an option. The Envy made it much easier, and I got down to work playing Enemy Territory, Portal, and Team Fortress 2. (It's a hard job, but someone has to do it.)

All of them looked spectacular, of course. The frame rates were better and I could finally crank all the graphic settings up to 11. This is gaming at the bleeding edge. More to the point, the quadruple fans and the case design kept the unit cool even through several hours of heavy use, erasing any doubts I had about the practicality of quad cores in high-end gamer laptops.

But I play action games on consoles all the time, and after a hefty chunk of Halo 3, Gears of War, and BioShock on 360, would the experience be that different? In a word, yes—but only in ways a hardcore PC gamer would notice. BioShock looked great on 360, but a powerful PC provides deeper colors, better textures, and more convincing fog effects. This was all obvious in a side-by-side comparison, but it wasn't something that struck me when I simply played BioShock on the console, which leads to the $5,200 question: Does a $5,600 PC outperform a $400 Xbox enough to warrant the massive added expense?

For the true hobbyist, no question. The clincher was Medieval 2, a game that gives my current desktop the yips. Once I cranked the graphics up to the max and saw hundreds of detailed units clashing in complex and realistic battles, I remembered what makes PC gaming so special. And if that's your passion, who can put a price on it?

So, does that mean when my loaner period is up, I'll buy one?

Hell no!

Who has that kind of money?

Thomas L. McDonald has been covering games for 17 years. He is Editor-at-Large of Games Magazine.

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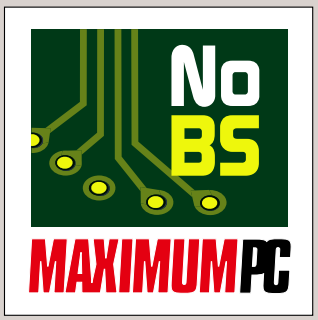


Nobel Prize for Hard Drive Tech

Two scientists get gold-plated medals, but we get 4TB drives

Some 19 years after independently discovering the phenomenon known as giant magnetoresistance (GMR), Albert Fert and Peter Grünberg have been awarded the 2007 Nobel Prize in physics. The technology, which describes a decrease in electrical resistance in the presence of a magnetic field, has had a huge bearing on hard drive development. GMR was responsible for the dramatic growth in drive capacities in the early 2000s, allowing hard drive heads to become smaller and the areal density of platters to increase.

In recent years, GMR was replaced with an alternative tech, but it appears to be poised for a comeback. It's the basis for a capacity breakthrough that Hitachi just announced. By revisiting GMR, Hitachi researchers have discovered a way to shrink drive heads to somewhere between 30 and 50 nanometers—2,000 times smaller than the width of a human hair. For us it means that 4TB desktop drives and 1TB notebook drives could be available as early as 2011.

Google and IBM Donate 1,600 Computers to 'Cloud' Project

It stands to reason you would be able to tackle a task more effectively with many computers than you could with one—the challenge is getting the many to work in concert. That's why a number of U.S companies and universities are devoting resources to the creation and application of "cloud" computing projects. Clouds are essentially clusters of computers—numbering from dozens to thousands—that process data simultaneously.

Google and IBM recently donated 1,600 computers to be used for this purpose to three universities. One, the University of Maryland, plans to use its cloud to translate difficult foreign language texts. Students there will write the software to take advantage of the cloud computer. Participants believe such training is essential for keeping pace with the growing amount of data needing to be processed.

Yippee Ki Yay, Harry Potter

Movie studios make concessions to fair use—sort of

What do Harry Potter and John McClane have in common? Seemingly nothing, but both characters' franchises are the first to include PC-friendly copies of their latest movies alongside the DVDs. Here's how it works: When you pick up the special-edition DVD of *Live Free or Die Hard*, you'll get two discs. One DVD is the plain-ol', just-like-any-other-DVD movie, and the other is a hybrid of special features and a digital copy of the film suitable for playback on your PC or media player. Pop the *Die Hard* disc in your computer, enter a special serial number printed on the DVD's box, and the loading program will output a DRM-free version of the movie to your hard drive. While *Die Hard* will ship without encumbrance, *Harry Potter and the Order of the Phoenix* will likely contain copy protection that will work with PlaysForSure-enabled devices. No doubt, these fair-use editions will come at a higher price.

Music Labels Get the Heave-Ho

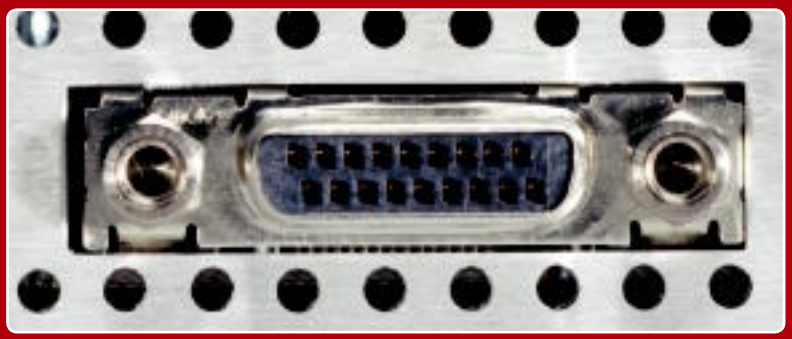
Radiohead shocked the music industry in October when it announced that fans would be able to set their own price for the band's latest album, *In Rainbows*. Eschewing major-label support, Radiohead offers two options—a digital download of the album's songs at whatever price fans think fair or a deluxe CD-and-vinyl box set loaded with extras for £40.

Now other artists, including Nine Inch Nails (whose front man, Trent Reznor, notoriously advised fans at a recent concert to steal his music), Oasis, and Madonna have all stepped off the major-label bandwagon—although Madonna has signed with a concert promoter instead.

Granted, these acts have devout fan bases, which makes such rebellion a lot less risky than it would be for artists of lesser renown. But clearly, consumers are not alone in their disdain for the major labels' dominance of the music market.

Win a PNY XLR8 8800 Series Graphics Card!

If you can correctly identify this connector, you'll be eligible to win a killer videocard valued at $400.



Go to www.maximumpc.com/article/what_the_hell_is_it for complete contest rules.

FUNSIZENEWS

IPHONE OPEN TO THIRD PARTIES

After much public outcry and the threat of a class-action lawsuit, Apple has finally agreed to allow third-party apps to run on its precious iPhone. Steve Jobs made the announcement on Apple's website and predicted that an SDK would be in developers' hands by February. Could it be long before the iPhone is open to alternative cellular providers?

BD+ EQUALS BAD

One of Blu-ray's big selling points to studios has been BD+, the extra layer of copy protection the optical spec offers over competing HD DVD. But based on its debut, BD+ is nothing to crow about—unless hurting honest consumers is the desired effect. BD+ is found in the recently released *Fantastic 4: Rise of the Silver Surfer* and *The Day After Tomorrow*, and owners of various Blu-ray players are reporting problems playing the discs. Some, but not all, of the players are fixed with a firmware update.

NOT TO PILE ON BLU-RAY, BUT...

Months after Blockbuster cited consumer preference for Blu-ray over HD DVD, Netflix is reporting the exact opposite findings. The popular online movie rental website says that of the admittedly miniscule number of consumers who are interested in a high-def format, more choose HD DVD, by a factor of 2.4 to 1.

U.S. CHEATING AT CARDS?

It's hard to believe that U.S. policy is rubbing foreign countries the wrong way, but the EU, India, and others are accusing the U.S. of discriminatory trade practices. The alleged violation stems from the U.S. ban on overseas Internet gambling sites, while similar operations are permitted to run domestically. If the World Trade Organization rules in favor of these countries, the U.S. could be ordered to pay $100 billion in penalties, an amount equal to the value of its land-based and online gambling market.

MOBILE HARD DISKS

Hybrid Drive **vs.** Traditional Drive

A new form of mobile storage was born when an engineer went running down a hallway while holding a hard drive and ran smack into another engineer carrying flash memory. Before he could say "You got flash RAM on my hard drive!" the concept of a hybrid storage device was well at hand. Hybrid hard drives employ flash memory as supersized buffers and promise better performance, less power consumption, and increased reliability.

But do they deliver on all those claims? To find out, we pitted Samsung's FlashON HM16HJI against itself—running all our tests with and without the drive's onboard flash memory enabled to find out if hybrid technology is really about hard benefits or just hype. In addition to holding 256MB of flash memory, this SATA150 drive spins at 5,400rpm and packs 160GB of storage across its magnetic platters. We used our trusty Asus C90s notebook and Windows Vista Home Premium to test the drive in both scenarios.

BY GORDON MAH **UNG**

SAMSUNG'S FLASHON HM16HJI
Features 256MB of flash RAM integrated with the 160GB drive
$100, www.samsung.com

round 1 **RELIABILITY**

Long-term hard-disk reliability is nearly impossible for anyone to gauge in a meaningful fashion. Still, common sense dictates that a hybrid drive should be more reliable over time. In theory, a

tear because the OS can write data to the flash RAM instead of spinning up the motor, platters, and heads every time you save a file. Because the OS spends a good part of its time writing to flash, the odds of you causing the head to crash when you, say, jostle or whack the notebook are lower than with a standard drive. But if this is the

[redacted]

ers be offering longer warranties? Nonetheless, hybrid technology certainly can't hurt reliability. Even if you finally wore out the flash RAM, which would take decades, the drive would still work.

WINNER: HYBRID DRIVE

round 2 **POWER CONSUMPTION**

Drive makers and Microsoft claim hybrid drives have substantial power benefits

power. The more times you spin up, the more power you use. A hybrid drive's larger buffer (256MB vs. 8MB) can theoretically reduce the number of times the OS has to reach out to the platters to read or write data. But who are we kidding here? While that might be true under certain workloads—those that only skim data from the flash memory buffer—our own tests found negligible power savings from hybrid technology. In the majority of workloads, you'll exceed the flash's 256MB capacity and thus tap the battery anyway. We expect to see more of a power savings when onboard buffers get larger.

WINNER: TIE

round 3 **OS SUPPORT**

OK, Linux users, Mac folk, BSD heads, Windows XP peeps, and, umm, BeOS dudes, please get the hell off this bus because hybrid drives work only with the inbred European royalty of OSes: Windows Vista. Yep, hybrid drives are currently supported in Vista exclusively, as part of the Microsoft feature called ReadyDrive. It's not that support for hybrid tech is impossible in Linux or

other OS has seen fit to support it yet. And since Vista's been such a massive suc-

the technically savvy (not!), this category is easy to call.

WINNER: TRADITIONAL DRIVE

round 4 PERFORMANCE

Trying to gauge the hybrid drive's performance was difficult, as throwing a relatively large (in hard drive terms) 256MB buffer at traditional hard drive benchmarks can produce goofy results. However, we did see up to a 10 percent performance boost in PCMark05 and about a 4 percent boost in the real-world MobileMark 2007 test. So sure enough, hybrid technology can pep up your system.

But now for the real mind-bender. While Microsoft and drive makers claim faster boot and hibernation times with hybrids, we found that boot performance got slightly worse and hibernating took an additional four seconds. Maybe this is why drive makers are openly bitching about "unoptimized" drivers in Windows Vista.

WINNER: TRADITIONAL DRIVE

round 5 PRICE

With a street price of about $100, the 5,400rpm 160GB FlashON HM16HJI hybrid drive costs about 10 percent more than its spec-for-spec brother: Samsung's SpinPoint HM160JI. Considering you're getting newfangled hybrid technology for about $10, that's a pretty darn good value. Of course, when you realize that a 1GB USB key costs $10, you have to wonder why Samsung limited the flash RAM in this hybrid to 256MB. Wouldn't it be better to put that $10 toward a bigger drive or a bigger USB key?

WINNER: TRADITIONAL DRIVE

SAMSUNG'S FLASHON HM16HJI

With Vista's Hybrid support switched off, the HM16HJI acts just like a traditional notebook hard drive.

$100, www.samsung.com

BENCHMARKS

	HYBRID ON	HYBRID OFF
PCMARK05 HD	**3,602**	3,261
PCMARK05 XP STARTUP (MB/S)	**5.8**	5.1
PCMARK05 APP LOADING (MB/S)	**4.6**	3.9
GENERAL USAGE (MB/S)	**3.9**	3.6
VIRUS SCAN (MB/S)	**53.4**	50.0
FILE WRITE (MB/S)	**43.9**	40.6
BOOT (SEC)	43	
SHUTDOWN (SEC)	24	**20**
WAKE FROM HIBERNATE (SEC)	27	**25**
HIBERNATE (SEC)	38	**34**
WAKE FROM STANDBY (SEC)	2	2
STANDBY (SEC)	**6**	9
HD TACH AVERAGE READ (MB/S)	20	**33.6**
POWER CONSUMPTION OF NOTEBOOK WITH DISK I/O (WATTS)	**52.5**	53
POWER CONSUMPTION OF NOTEBOOK WITHOUT DISK I/O (WATTS)	**49.5**	51
MOBILEMARK 2007 RUN TIME (MIN)	99	99
MOBILEMARK 2007 PERFORMANCE	**107**	103

Best scores are bolded. Our test bed consists of an Asus C90s notebook with a 2.66GHz Core 2 Duo, 2GB of RAM, a GeForce Go 8600 GT, a 160GB Samsung HM16JHI, and Windows Vista Home Premium.

And the Winner Is...

Ier invest in a traditional notebook hard drive with a larger capacity or faster spindle speed. Drive makers complain Microsoft is sabotaging hybrid-drive performance with "unoptimized" drivers (naturally, Microsoft claims that all its drivers are perfectly up to snuff).

We agree with the drive manufacturers. To see hibernation times get worse with hybrid mode enabled makes no sense at all. Limited OS support also diminishes the appeal of hybrid drives, but we're confident support will expand with new iterations of this burgeoning technology. In time, better drivers and more onboard memory could make hybrid drives pretty damned sexy. But right now the implementation leaves us cold. MPC

Our consumer advocate investigates...

✓Quad Core P4 ✓WolfKing Won't Bunny Jump ✓Canon's 12.1MP Pinhole Camera

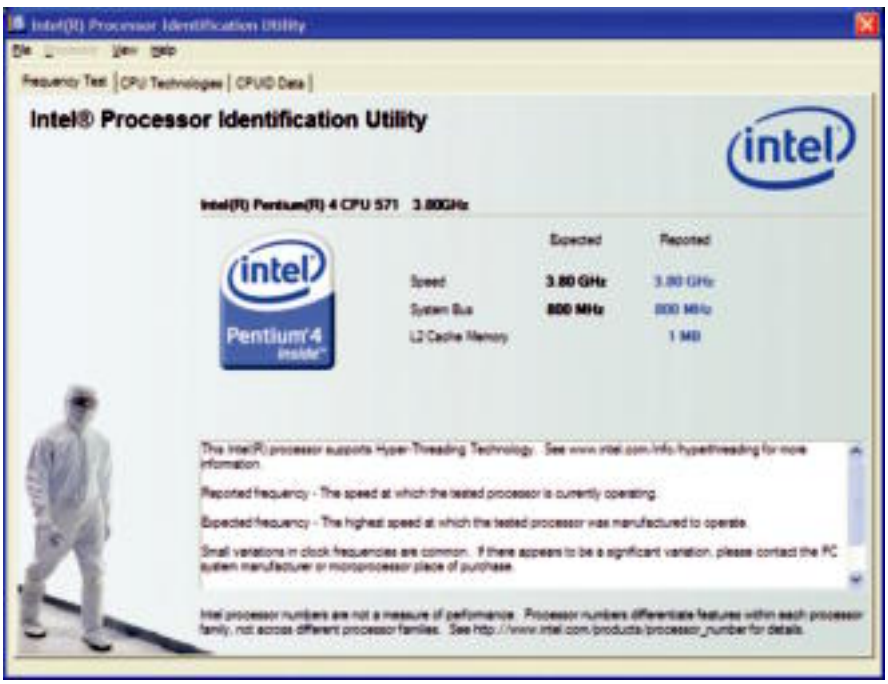
Hank, ***watchdog of the month***

QUAD-CORE PENTIUM 4?

In January, I purchased $3,000 worth of PC parts from Zipzoomfly.com, including a boxed retail Intel QX6700 Quad Core processor. I had numerous instability issues with my new rig spanning several months. After replacing literally everything else, I finally contacted Intel for warranty replacement of my boxed retail proc only to be told that the markings on my CPU were not that of a quad core! To make a long story short, Intel told me that my warranty was void because the proc is an "illegal re-mark" and that I should pursue a replacement with the vendor.

I have contacted Zipzoomfly.com more than a dozen times and the company has tried everything under the sun to dodge responsibility, including saying that I was beyond the 30-day return policy, and finally saying it has no way to recoup its money. So, in a nutshell, Zipzoomfly.com won't replace my CPU because someone is going to get shafted and the company prefers that it be me.

—Roger Westbrook



Running Intel's Processor Identification Utility on a new CPU is one way to make sure the Core 2 Duo you bought isn't an old Pentium 4.

Your problem is a disturbing one, Roger, as CPU re-marking has long been a bane of the industry. For those who don't know about it, CPU chip pirates take slower CPUs which are capable of overclocking and "re-mark" the surface to say it's a faster CPU. The profits come from selling the cheaper chip as a more expensive one. Re-marking isn't the problem it was five years ago—and we would hate for this to be a sign of its resurgence.

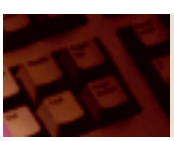
The Dog pinged Zipzoomfly.com to hear its side of the story. The company said the situation is unfortunate but it doesn't assume responsibility since Roger waited several months beyond the return policy period before contacting its support center. The spokesman said CPU orders are checked to see if the tamper seals are intact before they go out the door. The company also said they learned through their conversations with Roger that the machine did identify itself as a quad core during boot. The spokesman said that at one point, Roger told Zipzoomfly.com's support center that he had taken his machine to a local shop where a tech examined the machine out of Roger's view. So, although the company has sympathy for Roger, it has no plans to take the processor back because it believes the CPU was swapped after it was shipped to him.

The Dog went back to Roger who told the Dog that, yes, he had taken the machine to be checked, but he denied ever telling Zipzoomfly.com that the machine was out of his view. "I was talking with the tech the entire time and watching what he was doing," Roger told the Dog, "and as I've said, the symptoms continued after I got the rig back home, until it died completely, that is." Roger also said that he did not examine the tamper seals when it arrived but later noticed that one of the seals had been cut on the opposite side of the box he originally opened.

Oy, what a mess. A picture Roger sent the Dog clearly shows that the heat spreader says "Pentium 4," but Roger says it boots as a Core 2 quad core. Roger said he believes the heat spreader said P4 from the very beginning but admits that he did not look at the chip's markings until he spoke to Intel months later.

So is it a P4 or Core 2 quad core? The Dog spoke to David Brown, a senior engineer in Intel's security department and was told that there are no known hacks to make a Pentium 4 identify itself as a Core 2 chip. Brown said Roger's case doesn't sound like a classic re-marking problem but rather a "swapping" issue. Somewhere in the chain of custody, the CPU in the box was swapped out.

Intel's security department has seen re-marking problems drop off to almost nothing in



Got a bone to pick with a vendor? Been spiked by a fly-by-night operation? Sic the Dog on them by writing **watchdog@maximumpc.com.** The Dog promises to answer as many letters as possible, but only has four paws to work with.

recent years because newer CPUs are identified at the die level and are thus beyond remarking electronically, Brown told the Dog. You could, say, re-mark a cheap Core 2 Duo to physically say it's an expensive Core 2 Extreme, but it's impossible to make the OS or BIOS recognize it as a Core 2 Extreme, unless they were themselves hacked

But what if the holographic seals were intact on the box, surely that would protect you? Nope. Brown said that counterfeiters' skills are so incredibly sophisticated that even the holographic seals can be reproduced. The most foolproof method for protecting yourself is to download the CPU identification tool from Intel and check the proc yourself.

Although it looked like Roger was going to end up with a dead P4 instead of a shiny quad core, Intel reversed its decision and swapped Roger's chip for another Core 2 Extreme QX6700. The Dog must add that Intel's warranty department did this independently of the Dog's questions to the company about Roger's case, so hats off to the company.

The Dog doesn't necessarily hold Zipzoomfly.com to blame, as there is simply no way of knowing when the CPU was swapped. Roger certainly didn't help matters by reporting the problem months after the return period ended.

So what are the lessons to be learned? Number one, make sure you got what you paid for as soon as possible. If you're buying a part at a store, check the packaging. Many new packages actually put the CPU or videocard in a clear window so you can even check it without opening the box. If you buy an open box or returned item, check it in the store, or if that's not allowed, when you're paying for it. The cashier can be your witness and you can avoid claims by the store that you swapped the part yourself.

If you purchased an Intel CPU, download Intel's Processor Identification Utility at www.tinyurl.com/23z6mh. The utility will check any current Intel CPU and tell you if it's actually the chip you bought. AMD has a similar tool available at www.tinyurl.com/o0n. While it's possible to fool Windows XP, Windows Vista will identify the CPU string from the chip, so that's another option for verification. Third-party tools such as CPU-Z (www.cpuid.com) and GPU-Z (www.techpowerup.com/gpuz/) are also available to query your hardware. The key take-away is to check your hardware before the return deadline comes up. Woof.

NO BUNNY HOPPING WITH THIS KEYBOARD

I purchased a WolfKing CS Warrior keyboard. It worked fine for about a month and then quit. None of the keys would do anything, I even switched USB ports, but to no avail. I emailed WolfKing about my problem but didn't hear back after two weeks. I then called the support "hotline" numerous times only to get a recording that says, "We'll get back to you at our convenience." Which, as it turns out, is never. I sent six emails and still no response. The keyboard is under warranty but that doesn't help if I can't reach anyone. Has the company been skinned?

— Sgt. Bass 64

The Dog pinged WolfKing USA and heard from Bob Costlow, the company's director of sales and marketing. Costlow told the Dog, "I'm a bit puzzled at this complaint. I'm usually copied on any defect issue (of which there have been very few). I have not received any reports of a CS Warrior... as a defect or a phone message indicating an issue. I'll certainly look into it... [and to abide by the warranty period], I'd be happy to provide this user with a replacement unit ASAP."

Woof. MPC

Fix Alert

Canon's PowerShot A650 IS cameras could leak light when the LCD is exposed to sunlight.

Canon has issued a service alert for some of its new 12.1MP PowerShot A650 IS digital cameras, which may exhibit a light leak. The problem can occur when a person is shooting with the LCD display open and sunlight shining directly on the back of the camera causes a small overexposed rectangle to appear in the image. Canon did not say how many of the cameras have the problem, but it did say the problem affects PowerShot A650 IS cameras that have a 0 as the fifth digit of the serial number. For example, a camera with a 4816002105 would be eligible for the fix. Canon will repair any camera with the problem free of charge. The company also said the problem can be avoided in the short term by keeping the LCD closed during exposures. For more information, contact Canon at 800-828-4040 between 8 a.m. and midnight, Monday through Friday, or 10 a.m. to 8 p.m. on Saturday. Consumers may also contact Canon at carecenter@cits.canon.com.

THE GREATEST 100 PC TECHNOLOGIES OF ALL TIME

Over the years, these essential innovations have changed the way we use our PCs

BY THE MAXIMUM PC STAFF

Sure, we love iPods, TiVo, and fancy-schmancy digital cameras, just like everyone else. But let's talk about advances that make a difference where it really counts: in the PC.

While myriad best-of lists have ranked the greatest gadgets, software products, and videogames ever made, here we turn our attention to advances that have impacted the development, enjoyment, and raw power of the personal computer. Our staff-generated list looks at not just critical machines to come down the pike (#55), but also essential CPUs (#51), operating systems (#15), components (#18), and peripherals (#94), as well as the occasional piece of software (#74) and videogame (#9) that pushed PCs into new territory.

The result is an exhaustive look at the PC from its birth (#7)—and even its conception (#73)—to today (#71), piece by piece. Naturally, the list is skewed toward performance and gaming-oriented technologies. We respect WordStar as much as any high-tech historian, but you try typing a corporate memo when you've got a freakin' Shub-Niggurath (#6) bearing down on your ass.

So join us on a stroll through PC history and tip your hat to the technologies large and small that have either endured for decades or changed the game completely. As always, we anxiously await your complaints over what we forgot.

97 CONTROL-ALT-DELETE (1981)

We resort to the three-finger salute so often that the print is wearing off of these three keys on our keyboard. Serenity now!

95 FRONT PANEL CONNECTIONS (2001)

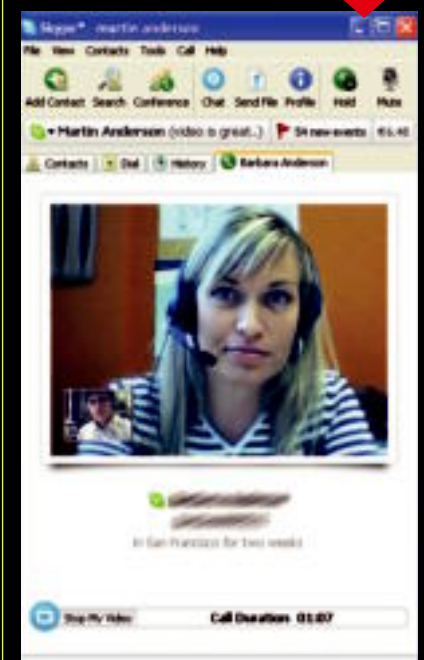
A big attaboy to the guy who thought of putting USB and headphone jacks on the front of the PC instead of only on the back. Flashlight use is down 30 percent since their introduction.

100 MICROSOFT SOLITAIRE (1992)

Laugh, but Microsoft's own website has more than 1,400 pages devoted to the ubiquitous Windows game (introduced in Windows 3.0). You know you play it.

96 SKYPE (2003)

VoIP existed long before this app came around, but Skype made Internet telephony easy enough for the average user. Free phone calls to Indonesia—yeah!



94 MICROSOFT NATURAL KEYBOARD (1994)

Many users found the split MS Natural keyboard awkward for typing, but a generation of carpal tunnel sufferers discovered that the ergonomic design was just what the doctor ordered.

99 APC UNINTERRUPTIBLE POWER SUPPLY (1984)

That beeping? It's the sound of you happily continuing your game of Wizardry while your neighbor reads by candlelight.

93 CONNECTIX QUICKCAM (1995)

While the webcam has been used for some dubious purposes (Editor in Chief Will Smith uses one to watch his *dog*), the idea behind it—to stream pictures and video to the Internet with cheap hardware—is a decent one. We think.

98 COOLER MASTER ATC-100 (2000)

Would people really shell out more than $200 for a box that merely stores their PC's innards? Cooler Master proved that cases need not be boring and started the trend in fashionable enclosures with this aluminum beaut.

92 MOZILLA FIREFOX (2004)

It's the open-source browser you know and love. Firefox regularly implements new features ahead of Internet Explorer, while also eating away at the latter's market share.

91 MICROSOFT FLIGHT SIMULATOR (1982) Pac-Man? Mario? Newbs. Versions of *this* classic simulator date back to 1977 (Microsoft got it in '82), making it arguably the longest continuously developed game series of all time.

90 ZONE LABS ZONEALARM (2000) In the sketchy early '00s, security exploits were rampant, and Microsoft offered no help. A good firewall was usually all that stood between you and the bad guys. ZoneAlarm was the best of the lot—and it was free!

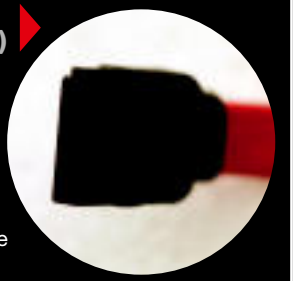
89 M-SYSTEMS DISKONKEY (2000) The first widely successful thumb drive worked without an onerous driver installation, plus it had a great nickname, the Donkey!

88 DSL (1998) Cable modems (see #23) seem to have beaten DSL in the broadband wars, but DSL was first on the scene, teaching us there was life beyond 56k.

87 A3D (1996) A surround sound experience with only two speakers? Aureal's A3D tricks the human ear into hearing more than is really there, and for that, we're duly impressed.

86 AMERICA ONLINE (1985) Go ahead and laugh. AOL may be a joke today (did you hear the one about the guy who tried to cancel his account?), but it got millions of people turned on to interconnectivity in the early Internet days.

85 SATA (2003) Finally, a successor to the fat-boy ATA/IDE cable (see #80). SATA allows for better cable management, better air flow, and, of course, far faster transfer speeds. It's even available in external form.



84 IOMEGA ZIP DRIVE (1994) A stopgap between the floppy drive and ubiquitous CD-R availability, the 100MB Zip disk was heavily used in the graphics industry to cart multi-megabyte files from one computer to another.

83 APPLE POWERBOOK 100 (1991) Despite some shortcomings, the PowerBook 100 revolutionized laptop design by moving the keyboard to the back of the unit, making it much easier to type on.

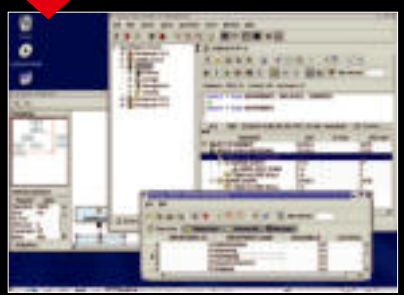
82 FLASH MEMORY (1984) While best known for its use as camera memory in products such as SD cards, flash is now making its way into solid-state hard drives and other performance-boosting applications in PCs.

81 BITTORRENT (2001) BitTorrent's ultimate impact is probably yet to be seen: Some estimates say the extremely popular P2P protocol now consumes up to 75 percent of all net traffic.

80 ATA (1986) Western Digital pioneered this ribbon-cable standard for hard drive connections more than 20 years ago, despite early cables that were prone to shorting and breaking down altogether.

79 HP LASERJET III (1990) This workhorse printer became a mainstay in office environments, where you can still find them cranking out pages today. In 1991, the LaserJet IIISi introduced network printing to the world while simultaneously ensuring continued work for IT guys.

78 RED HAT LINUX (1995) A pioneer in commercial Linux software, Red Hat legitimized the open-source space and helped other projects, such as Ubuntu (see #50), get their footing.



77 CAMBRIDGE SOUNDWORKS MICROWORKS (1996) Cambridge SoundWorks invented the satellite/subwoofer concept, and its introduction of the divine 2.1-channel MicroWorks blew the PC market wide open. Eleven years later, our Lab set is still thumpin'.

76 TRS-80 COLOR COMPUTER (1980) This chunky, supercheap proto-PC at least *looked* like a computer, introducing many to BASIC and LOGO programming, as well as the joys of the tape drive.

75 OSBORNE 1 (1981) A pre-Compaq "luggable," the Osborne 1 was a CP/M machine that came preloaded with business applications like WordStar. Osborne's meteoric rise and almost immediate fall are one of computing's great and tragic yarns.

74 EUDORA (1988) Originally the programming project of a University of Illinois student, Eudora made the world of email available to millions of consumers—those who didn't use AOL, anyway.

73 MITS ALTAIR 8800 (1975) This "lowercase" pc featured an Intel 8080 CPU and was primarily a kit computer for hobbyists, sold via an ad in *Popular Electronics*. This early bird turned people on to the primitive possibilities of 'puters.

72 MICROTEK MSF-300Z (1989) Today, scanners are so cheap and easy to produce they are practically given away, but they were once expensive monstrosities that were nonetheless necessary in the pre-digital-photo age.

71 HITACHI 7K1000 (2007) One 3.5-inch drive. One terabyte of storage. It took 13 years for the hard drive industry to surmount its second "big" barrier (see #18). Will we see petabyte drives by 2020?

70 LIQUID COOLING (2000) A bit clunky, sure, but the thermal benefits of liquid cooling are critical for overclockers pushing their PCs to the absolute limit.

69 INTEL 440BX (1998) Intel's third-gen Pentium II and Pentium III chipset represented the pinnacle of motherboard technology for years: 440BX boards regularly outperformed later models from Intel.

68 DVD (1995) Do we enjoy being able to cram 8.5 gigs on a disc? Yes. But we LOVE that our lives are free of nasty VHS tapes. Bonus: As a movie technology, DVD was released without a serious standards war surrounding it—refreshing!

A:A1: 'EMP

MENU

Worksheet Range Copy Move File Print Graph Data System Quit
Global Insert Delete Column Erase Titles Window Status Page Hide

	A	B	C	D	E	F	G
1	EMP	EMP NAME	DEPTNO	JOB	YEARS	SALARY	BONUS
2		177? Azrikan	4030	Sales	2	40000	10000
3	61964	Brown	6030	Sales	3	45000	10000
4	48371	Burns	6010	Mgr	4	75000	25000
5	58706	Caesar	7030	Mgr	3	65000	25000
6	49695	Curly	3030	Mgr	5	65000	20000
7	3479?	Dabarrett	7030	Sales	2	45000	10000
8	84084	Daniels	1030	President	8	150000	100000
9	5993?	Dempsey	3030	Sales	3	40000	10000
10	51515	Donovan	3030	Sales	2	30000	5000
11	48331	Fields	4030	Mgr	5	70000	25000
12	91574	Fiklore	1044	Adrin	8	35444	---
13	64596	Fine	5030	Mgr	3	75000	25000
14	13774	Green	1010	Mgr	5	90000	25000
15	55057	Hermann	4030	Sales	4	50000	10000
16	31619	Hodgedon	5030	Sales	2	40000	10000
17	1771	Howard	2030	Mgr	3	30000	25000
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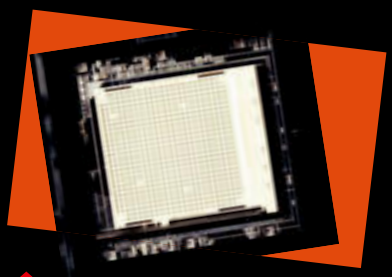
19	23987	Johnson	1030	VP	1	100000	50000
20	7166	Laflore	2030	Sales	2	35000	5000

DATA.WK3

67 LOTUS 1-2-3 (1983) You might not have spent your formative computing years futzing with spreadsheets, but legions of suits certainly did, turning 1-2-3 into the PC's first "killer app."

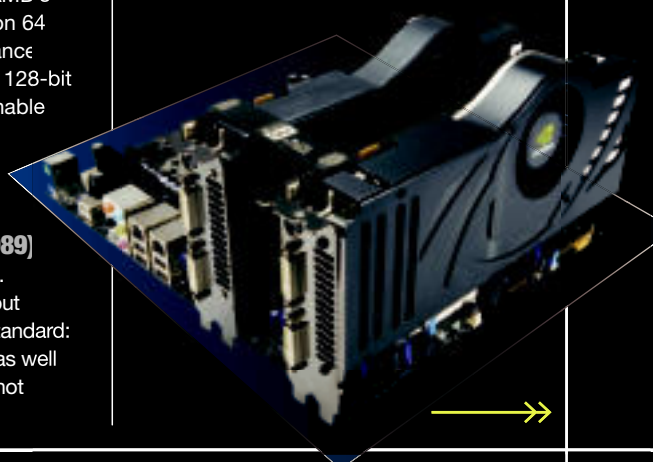


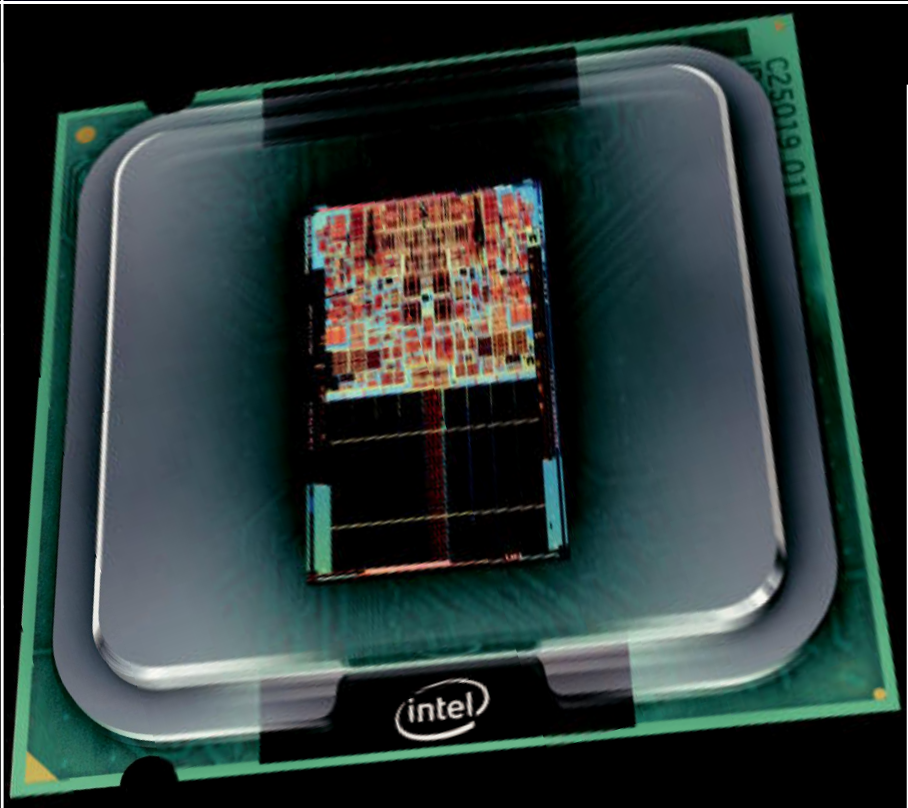
66 SOCKET 939 (2004) AMD's second-generation Athlon 64 socket offered a handy performance boost thanks to its dual-channel 128-bit memory interface. All at a reasonable price, too.

65 MICROSOFT WORD (1989) WordPerfect is for sissies. Microsoft Word may be bloated, but there's a reason it's the industry standard: It can do anything you want it to, as well as thousands of things you need not know about.

64 3.5-INCH HARD DRIVE (1987) Finally supplanting the old 5.25-inch formfactor, the 3.5-inch hard drive became an enduring standard that shows few signs of slowing down.

63 NVIDIA SLI (2004) The laws of computing shouldn't really let you shove two graphics boards into a PC and boost your performance, but somehow they do. Nvidia's unlikely technology (which various vendors had tried to develop for years) has helped the company decimate the competition in high-end graphics.





62 INTEL CORE 2 DUO (2006)
Desktop or mobile, it's the chip to beat in today's computing environment, offering the best performance on the market by a wide margin.

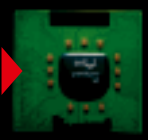
61 DIVX (2001)
No, not the disposable DVD format. DivX is the world's best hope for a universal compressed video-encoding format. Many set-top DVD players even support the format.

60 MCAFEE VIRUSSCAN (1989)
You just didn't run Windows in the '90s without antivirus software. You still don't, come to think of it.

59 AGP (1997)
Intel pioneered the AGP slot to provide better bandwidth for graphics cards, without having to share the clogged PCI bus (see #34). The standard was an instant hit, surviving until the PCI Express era.

58 PERPENDICULAR HARD DRIVE RECORDING (2006)
Originally developed in the 1970s, Seagate finally implemented this hard-drive technology in 2006. It's perhaps the most important single innovation to hit magnetic storage in decades.

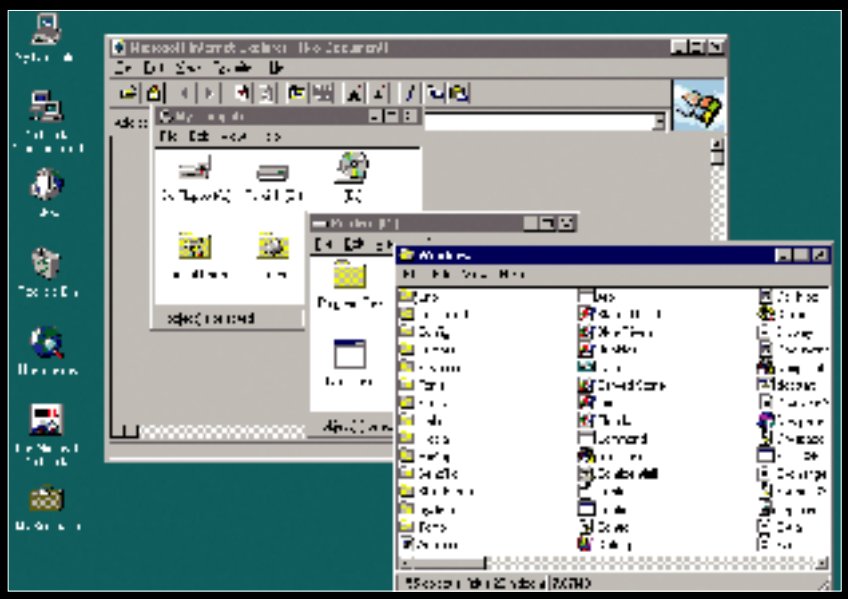
57 INTEL PENTIUM M (2003)
After decades of seeing manufacturers cram desktop chips into laptops, Intel wised up and developed a low-power chip with surprisingly good performance, finally bridging the performance gap with desktop Pentiums.



56 WESTERN DIGITAL RAPTOR WD360GD (2003)
This 10,000rpm, 36GB hard drive introduced high-speed SATA storage. Despite its now-smallish size, it remains a top choice for high-performance users.

55 APPLE MACINTOSH (1984)
Apple changed the computing game with this humble (yet spendy) beige box, launching the mouse-driven GUI as we know it today.

54 AOL INSTANT MESSENGER (1997)
Would you ever have thought that the de facto industry-standard IM client would be a product from America Online? We sure didn't.

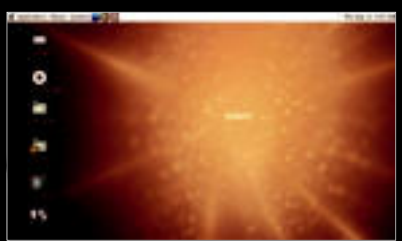


53 WINDOWS 95 (1995) At last, PC users got true multitasking and a less heinously ugly UI with the launch of Win95. Long file names! A TCP/IP stack! The Rolling Stones's "Start Me Up"! What's not to love?

52 DELL ULTRASHARP 2405FPW (2005) This giant LCD offers numerous video inputs and unimpeachable quality, and it made large-scale, widescreen graphics affordable to the masses.

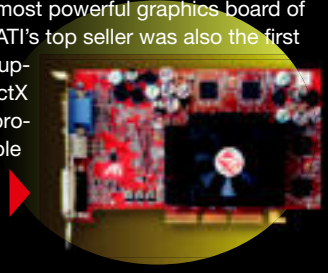
51 INTEL PENTIUM (1993) Intel finally dropped its long-held numerical naming scheme (due to trademark issues) with the launch of the Pentium. This was also the first Intel chip to feature a dual pipeline and, with its 64-bit data path, took baby steps toward 64-bit computing.

50 UBUNTU (2004) At long last, a Linux for the masses became a reality in the form of the easy-to-install and (relatively) easy-to-use Ubuntu. Dell's even preinstalling it on PCs as a Windows alternative.



49 MIRABILIS ICQ (1996) Instant messaging got its start with ICQ. Believe it or not, the now-cumbersome app is still being actively developed.

48 ATI RADEON 9700 (2002) The most powerful graphics board of its time, ATI's top seller was also the first card to support DirectX 9's fully programmable shaders.



47 STARCRAFT (1998) The best-selling computer game of '98 is one of the most enduring strategy titles of all time. Nine years on, it's still being used in professional gaming tournaments, especially in Korea, where StarCraft matches are regularly televised.

46 INTEL 430FX TRITON (1995) Socket 7 (see #35) wouldn't work without a motherboard for it to sit on. Intel's original Triton chipset also stabilized a frustrating PC industry, then marred by buggy third-party chipsets and incompatible technologies.

45 3.5-INCH FLOPPY (1983) Sure, they were slow and prone to failure, but consider the alternative: 5.25-inch floppies. This hard-shelled storage standard at least got us through a decade and a half of portable storage.

44 NAPSTER (1999) Shawn Fanning made history in more ways than one with this P2P app/service. Everything from iTunes to BitTorrent owes its existence to Napster, and for that, Mr. Fanning, we thank you.

43 MICROSOFT INTELLIMOUSE EXPLORER 3.0 (2003) Microsoft itself refers to the IME 3.0's comfort and control as "legendary," and we won't argue with that. This mouse finally made optical sensors the standard for PC mice. It was so popular Microsoft recently reissued it.

42 386 ENHANCED MODE (1992) The beginning of multitasking! 386 Enhanced Mode let you use your newfangled 80386-based PC plus Windows 3.1 to run DOS apps in multiple resizable windows.

41 WINDOWS 98 SECOND EDITION (1999) While Win98 was an evolutionary improvement over Win95, Win98 SE was a must-have upgrade because of one key feature: It let you use USB with far fewer headaches.

40 COMMODORE 64 (1982) Those of you who were too broke to buy an Apple got one of these $595 jobbies instead. Boulder Dash FTW!

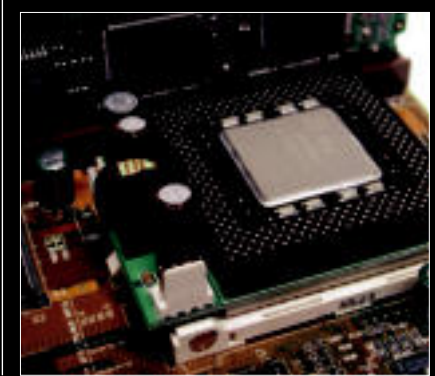
39 EPSON MX-80 (1982) Is there any sound so gratifying as the deafening whirr/grind of a dot-matrix printer? Epson's MX-80 made cheap printing available to the masses, who didn't seem to mind its low-grade quality or the noise as long as they could keep churning out rad Print Shop banners.

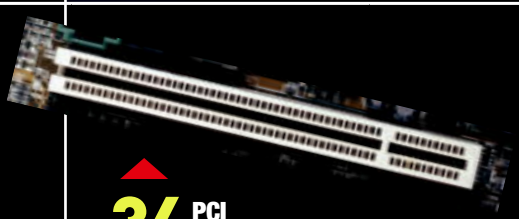
38 IBM THINKPAD 700 (1992) Portable computing was a decidedly unpleasant affair for a decade, with obese, underpowered laptops ruling a small market. That changed with IBM's entry into the business: the groundbreaking ThinkPad, which finally proved that powerful computers need not be the size of a server room.

37 APPLE II (1977) Steve Jobs's real breakthrough was the watershed Apple II, which got enthusiasts into home computing with an affordable, expandable machine.

36 CD-R (1988) We could read optical discs (see #26), why not write to them as well? CD-R rapidly made optical the medium of choice for backups, sneakernet file swapping, and every other storage need.

35 SOCKET 7 (1994) Once upon a time, all CPUs worked with the same motherboard: That time was 1994, when Socket 7 allowed you to plug in not just Intel CPUs, but also AMD's, Cyrix's, and other vendors' chips.





34 PCI (1993) The PC had been saddled with the pokey ISA bus for more than a decade before a successor arose in the form of PCI. This 32-bit slot proved perfectly capable of handling all manner of peripherals and was the standard for graphics connectors for most of the '90s.

33 DELL ULTRASHARP 2001FP (2003) Early LCDs looked pretty on your desk but were too slow for gaming. This 20-inch LCD from Dell was the first to approach CRTs in response time.

32 GL QUAKE/QUAKEWORLD (1996) These mods for Quake (see #6) showed how far graphics could be taken, even in this era of early 3D. GL Quake's tweaks changed the game in unpredictable ways, while QuakeWorld launched serious, lag-free multiplayer twitch gaming.

31 MATROX G400 (1999) Two of anything is better than one, particularly when it comes to displays: The G400 handily launched the multihead craze with its dual VGA outputs.

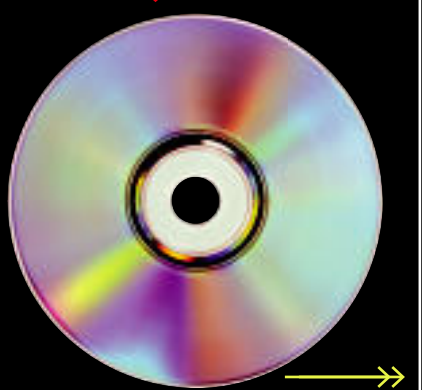
30 COMPAQ PORTABLE (1983) It's critical for two reasons: In one machine, Compaq invented the PC clone market *and* the portable computer. Not bad for a company with no track record at all.

29 ADOBE PHOTOSHOP (1990) This is the reason everyone looks better in photographs than they do in real life. It's also reportedly the most pirated application ever.

28 ATX (1995) Finally evolving the long-standard AT motherboard formfactor, ATX solved some key problems with the AT mobo and case, like its soldered power-supply connectors and archaic connector selection. Want to see how enduring ATX has been ever since? *Look inside your PC.*

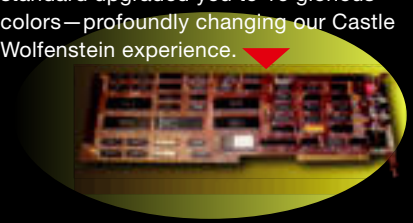
27 AMD ATHLON 64 (2003) Intel's hegemony of the processor world came to an abrupt, albeit temporary, end in 2003, with this first consumer 64-bit CPU. While Intel retook the performance throne with the Core 2 Duo's release, A64 features such as an on-die memory controller are still groundbreaking.

26 CD-ROM (1984) It was a short hop from digital audio to computer data, with software manufacturers finally shipping titles (initially heavy on reference books) on CD instead of floppy. The optical disc format would eventually lead to the floppy's demise and remains popular today.



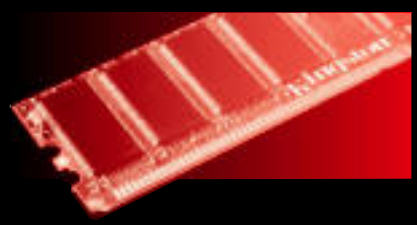
25 HALF-LIFE (1998) The best-selling PC shooter of all time, and for good reason. Half-Life combines groundbreaking graphics with an intriguing storyline, unique among FPSes and spawned a new generation of immersive first-person games.

24 IBM CGA CARD (1981) The popular Hercules Graphics Card gave you every color you could want, as long as it was green. IBM's CGA standard upgraded you to 16 glorious colors—profoundly changing our Castle Wolfenstein experience.



23 CABLE MODEM (1996) Consumers initially fretted that cable broadband's "shared" connection would cause prime-time traffic jams, but that never really happened. Cable's superior throughput and better stability have made it the broadband connection of choice for the digerati, at least for now.

22 DDR SDRAM (2000) For a while in 2000, it looked like we might be forced to shell out for pricey RDRAM to prevent memory bottlenecks in our PCs. DDR SDRAM saved the day by doubling memory bandwidth at a reasonable price.



21 IBM PC KEYBOARD (1981) The IBM 5150 (see #8) isn't notable for just its innards, it also had one of the most reliable and usable keyboards ever—a loud, mechanical beast that was rated for over 100 million keystrokes... *per key.*

20 CREATIVE LABS SOUND BLASTER 1.0 (1989) With no real onboard audio system in most PC clones, gamers needed an add-in card to make sweet, sweet sound come from their machines. Creative's Sound Blaster was an instant hit.

19 LITHIUM-ION CELLS (1991) Finally replacing low-power, environmentally hazardous nickel-based battery packs, lithium-ion made portable computing a possibility for more than an hour at a time, with the added excitement of an occasional "exploder."

18 WESTERN DIGITAL CAVIAR 1GB (1994) While IBM invented the first true gigabyte hard drive years earlier, it weighed 550 pounds and cost $40,000. WD broke the 1GB barrier for home users in June 1994.

17 FAST ETHERNET (1995) Bumping old twisted-pair Ethernet from 10Mb/s to 100Mb/s, Fast Ethernet became the industry standard for wired networking, finally killing off competitors like Token Ring and 10Base2.

16 NVIDIA GEFORCE 2 (2000) Though architecturally a mess, the GeForce 2 was the first pixel-shading GPU, bringing 3D graphics into the mainstream with its advanced lighting techniques and filtering features.

15 MS-DOS (1980) So simplistic it was originally called QDOS (Quick and Dirty Operating System), MS-DOS was critical for introducing computing to the mainstream without the vast complexity of UNIX and mainframe OSes.

14 INTEL 486DX (1989) The addition of an on-chip cache, FPU, and, most importantly, instruction pipelining ushered in a chip architecture that would endure until the multicore era. This chip was produced all the way until September 2007.

13 802.11B (1999) The industry had toyed with wireless technologies during the late '90s, but the advent of 802.11b finally provided a cable-free networking system with enough bandwidth and range to begin the inexorable shift away from Ethernet.

12 MOUSE (1963) Stanford's Douglas Engelbart developed the original mouse during the 1960s, finally patenting it in 1970. Xerox added a ball in 1972, then Apple stole it and the rest is history.

11 MP3 (1991) This lossy compressed audio format got the digital media revolution started. Despite numerous competitors, it's still the only universally supported music format.

10 DIRECTX (1995) Microsoft's graphics API has evolved from a tricky method to fool Windows into playing games into a sophisticated, industry-standard PC graphics platform. Yes, *that* Microsoft.

9 DOOM (1993) Never mind Wolfenstein 3D, it was Doom that put 3D PC gaming on the map—so to speak. The game is so insanely popular it's been ported to just about every platform imaginable, from cell phones to workstations.

8 IBM 5150 (1981) With 16KB of RAM and up to two internal 5.25-inch floppy drives, the 5150 was the first modern PC. While it was priced out of reach of most consumers, the technology (obviously) endured. Many 5150s are still running today.

7 HAYES SMARTMODEM (1981) Hayes pioneered consumer modems, which let patient PC users speak to other PCs in the pre-broadband days. Though few people use them anymore, they're still integrated into virtually every desktop and laptop.

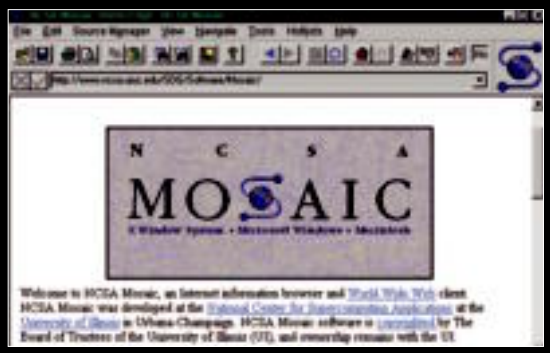
6 QUAKE (1996) Earlier titles like Doom (see #9) and Duke Nukem 3D hinted at what the future of gaming would look like, but Quake finally fulfilled the promise, replacing 2D sprites and maps with real 3D models and environments.

5 WINDOWS XP (2001)

Is XP the best Windows of all time? Windows 95 (#53) and 98 (#41) were both influential, even groundbreaking, but the stability and speed of XP have already made it endure far longer than either of those OSes. XP's additional features, like Remote Desktop, device driver roll-back, ClearType, and better multi-user support make it a must-have upgrade, but the general reaction to XP's successor, Windows Vista, really pushes XP into classic territory. The widespread rejection of Microsoft's latest bloated OS will give XP even more life than it might otherwise have had.

4 NCSA MOSAIC (1993)

If one application had a more profound impact on modern-day computing than any other, it is Mosaic, the first web browser, which was developed by the National Center for Supercomputing Applications. Before Mosaic, the closest you could get to a graphical Internet was the occasional spot of ASCII art during your Telnet session. In conjunction with the HTTP protocol, the interconnected, fully graphical World Wide Web was born. Bits of Mosaic code are still found in most major browsers.

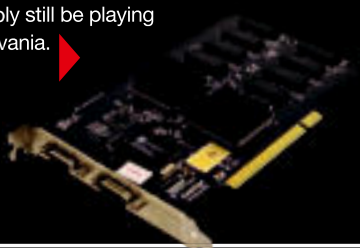


3 INTEL PENTIUM II (1997)

With the Pentium II, Intel tried something different, packing the CPU along with a daughterboard and a heatsink inside a slot-based package instead of an exposed-pin socket. The trick let Intel separate the L2 cache from the CPU, which increased cache size, while keeping prices down. The Pentium II significantly outperformed earlier CPUs, particularly when running then-hot "multimedia" functions. The chip cemented Intel's lead in the CPU market until the rise of the Athlon 64 (see #27).

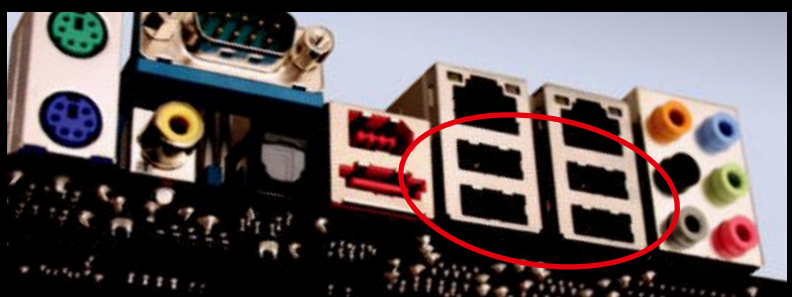
2 3DFX VOODOO 1 (1996)

The PC graphics market used to be even messier than it is today. When it got its start in earnest in 1996, with 3dfx's Voodoo 1 chipset, getting 3D graphics on your PC meant having an add-in card in addition to your standard VGA board and daisy-chaining them together. But gamers will put up with a lot, and the Voodoo 1 became an instant hit, powering must-have titles like Quake (see #6), which turned gaming from the pseudo-3D Doom era into a new realm of complexity and realism. Without the Voodoo 1, you'd probably still be playing Castlevania.



1 USB (1996)

No connector has proven more useful and reliable than USB, the first step away from the dog-slow legacy of serial and parallel ports. USB offered some unheard-of features for its time: the ability to connect peripherals without turning off the PC first (we call it hotswapping now), daisy-chain up to 127 devices together, and draw power without a separate AC connection. Though USB later upgraded throughput to 480Mb/s, it shrewdly kept the same formfactor, which effectively relegated competitor FireWire exclusively to DV apps and Macintoshes. MPC



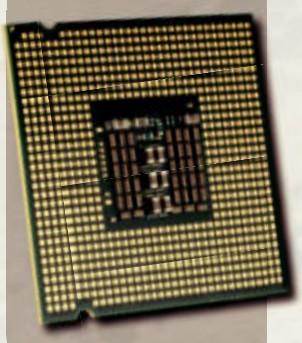
BEST OF THE BEST 2007

Every year, a procession of PC parts enters our Lab. Each component is tested mercilessly, but only a handful manage to win us over with a combination of killer performance, unique skills, and an all-inclusive feature set. Over the following pages, we pay tribute to those proud few and explain what makes them stand out among their peers in each major PC category. Ladies and gentlemen, we present this year's hardware best in show!

By The Maximum PC Staff

BEST OF THE BEST 2007

BEST CPU



Intel Core 2 Extreme QX9650

Intel's been on cruise control for more than a year, but that doesn't mean the giant has been asleep at the wheel. On the heels of its proven 65nm Core

gets tiny with a new 45nm process chock-

predecessor in a clock-for-clock comparison. But the real story of the 45nm Penryn chip is its clock-speed headroom. While the 65nm quad cores top out at 3GHz (with overclocked chips pushing 3.73GHz), the

process. The only downside to Penryn is that it won't work in some older motherboards. Nevertheless, this is the best CPU in town.
(See page 54) $1,000, www.intel.com

BEST MOTHERBOARD

Asus P5E3 Deluxe

If you don't like controversy, stop reading. After taking Asus's new P5E3 Deluxe motherboard and its new Intel X38 chipset for a ride, we're willing to toss aside conventional power-user wisdom and embrace this DDR3 non-SLI board as our top pick. *Wha, wha, what?!* Just hear us out: First, the board supports Intel's new 45nm Penryn—our favored CPU. Second, DDR3 is beginning to hit speeds that make it attractive—at 1,800MHz, who gives a damn about latency? We're also willing to forgo SLI support—for now—when single-card performance is so damned fast. (In the meantime, maybe Nvidia will finally unlock SLI on Intel chipsets.) The hardcore features and killer performance of this board make it worth the trade-off.
(Reviewed at http://tinyurl.com/2cvl4b) $280, www.asus.com

BEST AIR COOLER

Zalman CNPS9700 LED

The fact that we've adopted the CNPS9700 as a benchmark against which we compare all other coolers is a testament to the raw strength of this shiny little guy. It's just that powerful; it's loud too, but if you want your CPU temps lowered to the extreme, the CNPS9700 is the cooler to do it.
(Reviewed February 2007) $80, www.zalmanusa.com

BEST CASE

Cooler Master Cosmos

We've read the pages upon pages of forum posts complaining about the Cosmos: that it's too bulky, that it's too warm, that it sucks. Well, you disbelievers are wrong! We've found nothing but blissful joy when using this holiest of holy chassis. Its adherence to screwless construction and soundproofing, not to mention its front-panel eSATA support and durable exterior, made the Cosmos the natural choice for this year's Dream Machine, and it remains our favorite to this day. To praise this case more would require ticker tape and a flashy car.
(Reviewed October 2007) $200, www.coolermaster.com

BEST VIDEOCARD

Asus EN8800 GTX

The videocard market has been a one-horse race this year. Nvidia obliterated AMD without doing much of anything new. And while this might seem out of character for *Maximum PC*, we're not anointing a card with Nvidia's absolute fastest GPU—the 8800 Ultra—with our Best of the Best designation.

No, we've decided to stick with the 8800 GTX, as represented by Asus's EN8800 GTX. It's fast, it's quiet, and it delivers incredible performance with DX9 (its DX10 performance is admittedly less impressive). Yes, the Ultra is faster. It's also hotter and a whole lot more expensive. We just don't think the modest speed bump justifies the mountain of cash you'll need to acquire one.

(Reviewed January 2007) $550, www.asus.com

BEST OPTICAL DRIVE

(Reviewed October 2007) $70, www.samsung.com

BEST MONITOR

Gateway XHD3000

While we're still admirers of the large 1920x1200 native-res LCDs we've been recommending the last few years, the widespread adoption of these screens has definitely diminished their cachet. So we're thrilled that a *really, really* high-res screen is now a viable option. Thanks to Gateway's XHD3000, power users can enjoy all the benefits of a 30-inch, 2560x1600 panel without suffering any of the indignities inherent to other 30-inch LCDs. The XHD3000's unique use of an internal scaler means you can choose among multiple interface options, adjust the screen's image in a variety of ways, and play high-def content at its intended res. Righteous!

(Reviewed on page 80) $1,700, www.gateway.com

BEST WI-FI ROUTER

D-Link DIR-655 Xtreme N ess Router

It's been a long wait, but 802.11n wireless routers are finally worth buying—even if the IEEE hasn't published the final spec. After testing models from every major vendor, we found that D-Link's DIR-655 offers the best combination of features and performance. With unparalleled tweakability, customizable quality-of-service settings, best-in-class range and throughput, and a built-in Gigabit Ethernet switch, no other router comes close.

(Reviewed November 2007) $130, www.dlink.com

BEST HARD DRIVE

Seagate Barracuda 7200.11 (1TB)

We were inches away from declaring Hitachi's 7K1000 terabyte drive the best hard drive of 2007, when—*whammo!*—terabyte offerings from Western Digital and Seagate hit the Lab within a day of each other. Storage competition makes us salivate, so we couldn't wait to run the drives through our benchmark obstacle course. It's a good thing we did: Seagate's four-platter Barracuda 7200.11 drive is the fastest terabyte drive we've ever tested, with an average read speed of 86.6MB/s—a whole 15 megabytes a second faster than the 7K1000. Attribute the win to the Barracuda's increased areal density. At 250MB per platter, the 'Cuda packs more for a decisive read/write punch!
(Reviewed on page 78) $330, www.seagate.com

BEST BACKUP DRIVE

Seagate FreeAgent

Let's get the messy details out of the way first: The single-drive FreeAgent Pro

the storage mediums

Pro II supports only USB and FireWire connections, while the FreeAgent Pro provides support for both those specs as well as eSATA, making it the

transferring. And unlike

(Reviewed at http://tinyurl.com/28y9dg) $300, www.seagate.com

BEST THUMB DRIVE

Corsair Voyager GT 8GB

(Reviewed February 2007) $150, www.corsair.com

BEST DIGITAL MEDIA PLAYER

SanDisk Sansa Connect

There's plenty of buzz about Apple's new iPod Touch, but that device

for us to consider. No matter, we'll happily give SanDisk's Sansa Connect the win in this category. The Sansa Connect's built-in Wi-Fi capabilities tie into Yahoo's Launchcast Internet radio and Yahoo Music Unlimited services to provide a nearly unlimited source of music you can share with other subscribers.
(Reviewed July 2007) $150, www.sandisk.com

BEST NAS BOX

QNAP TS-109 Pro

It's hard not to love QNAP's TS-109 Pro network attached storage (NAS) box. For starters, it sprinkles magic dust over your data transfers—it was the speediest of all the NAS devices we've ever tested in both our small- and large-file transfer tests. The TS-109 also comes with a plethora of outstanding features: It can stream music (iTunes supported!), download BitTorrent files, act as a server, back up your PCs, and even pull files from USB devices. Consider us smitten!
(Reviewed at http://tinyurl.com/yomys5) $330—drive not included, www.qnap.com

BEST EARBUDS

(Reviewed August 2007, as model SE530PTH) $500, www.shure.com

BEST SPEAKERS

Audioengine 5

2007 was a good year for speakers, with a number of great systems going through the Lab's sonic chamber. TBI's passive Majestic Diamond I and B&W's incredible Zeppelin (reviewed on page 88) were both exceptional. But we're giving the nod to the Audioengine 5 bookshelf system, which combines outstanding character with features that render it useful for nearly

outlet in back that's just the ticket for powering a streaming box.
(Reviewed May 2007) $350, www.audioengineusa.com

WORST OF THE WORST

With so much killer hardware in our midst, you might think we're strangers to crappy products. Not so! Here are some of the lemons from 2007 and what we had to say about 'em

RESERVOIR DOGS

"By the end of the game, we were praying the cops would shoot us to put us out of

(REVIEWED JANUARY 2007)

BELKIN CABLE-FREE USB HUB

"If Belkin's Cable-Free USB Hub is any indication of what we can expect from other wireless USB products, the technology's future is bleak."

OVERWAY TECHNOLOGY VACUUM SUPERCONDUCTIVE HEAT COOLER

"Yes, it took more than half an hour to get the device in place. And for all that, we were rewarded with a cooler that actually performs worse than [a] cheapo stock cooler…"

TOSHIBA PORTABLE EXTERNAL HARD DRIVE

"We sure can't think of a compelling reason to pick up this device, as the Toshiba is as slow as it is featureless."
(REVIEWED NOVEMBER 2007)

PHILIPS AMBX GAMING PERIPHERALS

"Amsterdam is just 66 miles from Philips's headquarters in Eindhoven. Hmm. Could that drawing board, into a factory, and onto retailers' shelves without someone asking, 'Why?'"

COOLERMASTER ITOWER 930

"You could practically open a Greek restaurant

GENIUS HS-04U HEADSET

ABIT IDOME D500 DIGITAL 2.1

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WESTERN DIGITAL MY BOOK WORLD EDITION II

"If you love holding down a power button for more than 20 seconds just to shut off a device, you'll love WD's My Book World."
(REVIEWED AUGUST 2007) MPC

PENRYN

Up Close and Personal

We've been talking about the arrival of Intel's 45nm CPU for months. Now that this dynamo is in our clutches, we don't want to let it go!

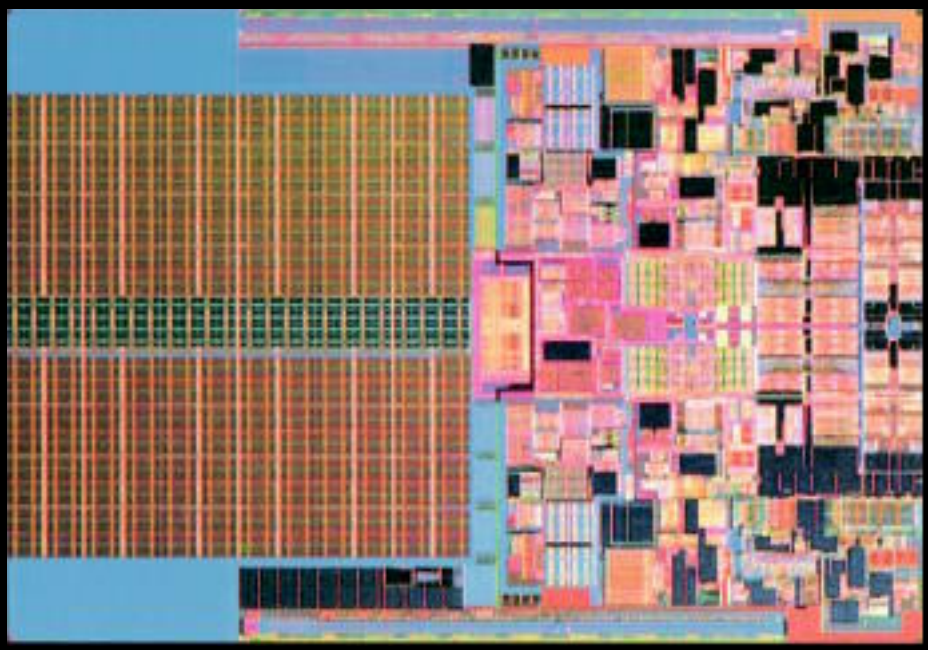
BY GORDON MAH UNG

Competition breeds excellence. But what happens when your competition pulls one of the greatest disappearing acts in technology history—seemingly giving up on the battle at the high end? Intel's answer is to keep hammering away, despite the absence of a challenge.

Read on for our in-depth look at Intel's answer to Phenom (AMD's as-yet-unshipped quad-core CPU). Smaller, faster, and cooler than its predecessor, Penryn will be one tough cookie to beat.

The Nuts and Bolts of It

We ask, and answer, the questions on every PC enthusiast's mind



Intel's 45nm die shrink allows engineers to pack nearly twice the number of transistors into the same space as a 65nm CPU.

Q What exactly is a Penryn?

A Penryn is the "family" name for Intel's follow-up to its 65nm Core 2-lineage CPUs. For consumers, Wolfdale will be the dual-core Penryn, Yorkfield will be the quad-core version, and Harpertown will be the quad-core Xeon workstation CPU.

The big enhancement is the process shrink from 65nm to 45nm. Intel calls its move to a 45nm process the "biggest change to computer chips in 40 years." Intel's tendency toward self-aggrandizement aside, the 45nm process is a significant jump forward, allowing twice as many transistors to fit in the space of a 65nm chip. The 45nm process also uses high-k gate dialectics. Not to be confused with L. Ron Hubbard's Dianetics, the high-k gate using hafnium oxide replaces the silicon dioxide gate that's been in use since the 1960s. The new transistor leaks less energy, produces less heat, and is able to switch faster than a silicon dioxide transistor by 20 percent. This boils down to smaller, faster, more power-efficient CPU cores. How much smaller? The previous Core 2 Extreme quad cores packed 582 million transistors within a space of 286mm^2. The Yorkfield quad core packs 820 million transistors into 214mm^2.

Q So what else is new under the hood?

A Penryn is more than a simple die shrink. The new CPUs are based on the Core 2 microarchitecture with a few tweaks that Intel hopes will keep it ahead of AMD. The headliner of these tweaks is the new SSE4 instruction set designed for media encoding and high-performance computing. Also new is a Super Shuffle Engine, which increases the speed of many SSE media-encoding instructions by doubling the processing units from 64-bit to 128-bit.

Penryn also includes a new Fast Radix-16 Divider that pretty much doubles the division math speed. Intel also reportedly boosted virtual machine performance by as much as 25 to 75 percent. And Intel added a new feature called Dynamic Acceleration Technology that essentially overclocks one of the cores when the others are sleeping.

The new chip also makes use of all the physical space freed up by the die shrink. (Imagine if all the stuff in your garage shrunk by 50 percent!) That's what accounts for the beefed up L2 cache, which at 6MB per core is a 50 percent increase over the L2 in 65nm quad cores. The larger L2 cache helps in numerous ways, but its biggest contribution is in ameliorating the potential performance hit caused by the ancient shared front-side bus architecture Intel uses for communication between cores. To keep the front-side bus from bogging down, the large and very efficient L2 cache ensures that the CPU has ample data close at hand so it won't be data starved. While Intel has certainly proved that the FSB strategy is still workable, the company has stated it plans to adopt an on-die memory controller in its next CPU.

Q How significant is the new SSE4 instruction set?

A Instruction sets in CPUs always garner the most attention but, sadly, are usually the last feature to actually add performance benefits. While the Fast Radix-16 Divider and the Super Shuffle Engine in Penryn *will* increase the performance on many existing applications, the 47 new instructions in SSE4 will not give you any performance boost until applica-

SPECS

MODEL	ATHLON 64 FX-74	ATHLON 64 X2 6400+ BLACK EDITION	INTEL CORE 2 EXTREME X6800	INTEL CORE 2 EXTREME QX6850	INTEL CORE 2 EXTREME QX9650
Clock Speed	3GHz	3.2GHz	2.93GHz	3GHz	3GHz
L1 Cache	128KB	128KB	64KB	64KB	64KB
L2 Cache	2MB	2MB	4MB	8MB total	12MB total
Front-side Bus	n/a	n/a	1,066MHz	1,333MHz	1,333MHz
Execution Cores	2	2	2	4	4
Process Technology	90nm	90nm	65nm	65nm	45nm
Transistors	227 million	227 million	291 million	582 million	820 million
Die size	230mm^2	235mm^2	142mm^2	286mm^2	214mm^2
Price per 1,000	$300	$220	$1,000	$ 1,000	$1,000
Interface	Socket F	Socket AM2	LGA775	LGA775	LGA775
TDP	125 watts	125 watts	130 watts	130 watts	130 watts
Dual socket compatible?	Yes	No	No	No	No

PENRYN
Up Close and Personal

tions directly support them. SSE4's main claim to fame will be in media encoding and high-performance computing (i.e., supercomputers). In fact, Intel's demonstrations of SSE4-enabled encoders showed incredible performance boosts. However, those demonstrations have been called into question, with skeptics suggesting that while the alpha build of DivX used for the proof-of-concept benchmarks is faster with SSE4, it's not a realistic scenario. One developer we spoke with told us: "The applicability of SSE4 for our codecs seems rather limited and the expected gain seems rather small (I expect no more than a 1- to 2-percent speed gain with SSE4) compared to the speed increment we got from SSE on pre-Core 2 Duo and SSE2 on Core 2 Duo. The SSE4-instructions that are often advertised as being especially targeted for video encoding are useless for us, since those instructions are only applicable for exhaustive search algorithm (ESA), which we don't use because of its inherent inefficiency."

Our take on SSE4 is that it will eventually become useful. That said, we wouldn't buy a CPU specifically for a new instruction set. By the time the support for the new instructions is there, it's likely that a newer, better processor will be available. If, however, you tend to use your CPU until it dies, it's better to have a new instruction set than not to have it. Case in point: Many otherwise useful Athlon XP machines can't run some newer applications because the elderly chip lacks SSE2.

Sadly, instruction sets have turned into marketing footballs these days. Not to be outdone, AMD has introduced the specs for SSE5—100 new instructions aimed at media encoding, high-performance computing, and possibly graphics.

Q Which Penryn CPUs will be available in 2007?

A Intel will launch 16 different Penryn-based CPUs in 2007 but, sadly, only one is meant for consumers: the top-end Core 2 Extreme QX9650. Running at 3GHz, this quad-core chip features 12MB of L2 and will run on a 1,333MHz system bus. Like all Extreme-class CPUs, multiplier-locking is removed to aid overclocking.

The fastest CPU of the family, however, will likely be the Xeon X5482, which clocks at 3.2GHz and operates on a 1,600MHz front-side bus. It's obvious to us that Intel is more intent on recapturing ground lost to AMD in the server and workstation market with this launch. In 2008, we expect Penryns in LGA775 trim to be more plentiful and cheaper.

Q So the QX9650 will overclock?

A From our preliminary testing, we can say, "Hell yeah!" Our QX9650 sample was extraordinarily stable running at 3.6GHz on a 1,600MHz front-side bus with DDR3/1600. This, mind you, was with a bone-stock Intel cooler and stock voltage settings. By comparison, Intel's current 3GHz Core 2 Extreme QX6850 hits the wall in the 3.6- to 3.7GHz range, and it takes water cooling and extra voltage to get there. With the QX9650, we could post and run the OS at 4GHz but benchmarks would crash.

We believe that additional cooling would do the trick for reliable 4GHz performance, but unfortunately, we didn't have enough time to get too nasty with CPU voltages this month. What we do know is that Penryn overclocks well and performance scales with the frequency. In 95 percent of our benchmarks, the 20 percent clock boost (combined with the DDR3/1600 and higher front-side bus speeds) gave us a 20 percent increase in performance. That's good news for Penryn and great news for overclockers.

Q If the QX9650 runs at 3.6GHz at stock voltage and Intel was showing off 3.33GHz samples six months ago, why is this chip launching at such a low clock speed of 3GHz?

A Sandbagging. There, we've said it. We think that without the threat of AMD looming in its rear-view mirror, Intel is sandbagging. The company denies it and says that it is launching at 3GHz to meet certain manufacturing goals. By upping the clocks 10 percent, the number of CPUs it manufactures that run at the more aggressive clocks could go down considerably. Whatever. Our hands-on experience with the QX9650 makes us believe that Intel dialed back the speeds because it doesn't need the chips to be faster right now when its only competition is the older QX6850. If Phenom FX comes out and is competitive, don't be surprised if a 3.33GHz or higher Core 2 Extreme pops out overnight.

Where the Heck Is AMD's Phenom FX?

Talk about pushing deadlines. When AMD said it would ship its Phenom in the second half of 2007, we didn't know that it meant the very last frakking month of the year. But that's how it's been for AMD, which has gone from gilded to grilled in less than 24 months. Its chief competitor beat it to quad-core CPUs by more than a year and is apparently so confident in its new quad core that it dropped the clock speeds by 10 percent. And then there's the Phenom FX pulling a "Where's Waldo?" act.

Add to that the company's continuing money woes, declining market share, rumors of a takeover by private equity investors, and the challenges of merging ATI into its operations, and it becomes clear that AMD is facing one of its most difficult times.

Despite all that, some light may finally be appearing at the end of the tunnel. The company began shipping some of its "true" quad-core Opteron chips in September. AMD also said it's making headway integrating ATI graphics into its platform and is already talking about its next next-generation CPU core, codenamed Bulldozer. Based on AMD's own 45nm process, Bulldozer will be a radical change from the company's current processors, with a completely modular design. Bulldozer will likely include the company's SSE5 instructions and the ability for the CPU to report performance metrics in real time to an application or OS so it can be tuned to run faster.

When Phenom and Phenom FX do arrive, the hardcore faithful are sure to be happy about one thing, though: backwards compatibility. Phenom FX and Phenom are expected to work in most existing Socket AM2 motherboards in consumers' systems.

PENRYN

Up Close and Personal

Q Is Yorkfield a "true" quad core, and does it even matter?

A If you've kept up with current events, you know that Intel builds its quad-core CPUs by mating two dual-core processors inside a CPU package, with the two entities communicating over the front-side bus. In a way, it's like a dual-processor machine, but both cores are stuffed into one package. AMD's upcoming Phenom FX CPUs are touted as "true" quad cores because all four cores are on the same piece of silicon. The advantage to AMD's approach is that the cores can all communicate at much, much faster speeds. For chip purists, AMD's design is far more elegant and forward-looking.

Even Intel recognizes that the future is in integrating all four cores on one die—its upcoming Nehalem CPU will use a similar design. For now, however, Intel can argue that it's better to have a bird in the hand than two in the bush. The technique of joining two dual cores has allowed Intel to sell a functioning quad core that kicks Athlon 64 butt for more than a year. AMD's quad core, meanwhile, is still nothing more than a slogan. Intel's pragmatic design also pays off in CPU yields, as it's easier to produce a large number of flaw-free dual-core chips on a silicon wafer than it is to produce quad-core versions. In fact, many wonder if AMD's plan to introduce a tri-core CPU isn't a way to recycle quad-core parts that have one bad core on them.

As far as we're concerned, all that matters is a chip's speed, not what new technology it uses. Case in point: Intel's Trace Cache in the Pentium 4 was a revolutionary feature at the time, yet it didn't help the Pentium 4 against the generally faster Athlon CPUs.

Q Is Penryn faster than the current Core 2 quad cores?

A We don't want to give away the punch line but, generally, an equivalent Penryn runs up to 14 percent faster when compared clock-for-clock with the current Core 2 quads. The exact speed increase depends on the benchmark. In some, you'll see no change in performance; in others, a healthy increase is possible. But remember, Penryn isn't the big leap forward. Intel's CPU schedule dictates a little jump one year and then a big jump the next year. This is the little jump. Intel hopes to make a big jump when it introduces its Nehalem CPU in late 2008.

Q Will Penryn work in my motherboard?

A Long-time Intel lovers have been vexed by this for years, as the company's been in the habit of invalidating perfectly good motherboards by requiring new or updated chipsets to run its latest CPUs. Want a 1,066MHz P4 on a 925X mobo? Sorry, you need a 925XE. Pentium D on a 925XE? Nope, you need a 955X chipset. Pentium 955 EE on a 955X? Guess again: 975X.

Fortunately, Intel has gotten a little better in this area, and there is a very good chance that a QX9650 will work in many existing motherboards. Certainly motherboards that use Intel's P35 and X38 chipsets will support the new CPU (although a BIOS update might be required). Some Intel 965 and 975X boards might also work with the new CPU and we understand that the majority of 680i boards will be compatible. To be safe, however, before you buy any board/CPU combination, check the manufacturer's website to see what processors it has validated with the design. Just because the Yorkfield and Wolfdale are LGA775 doesn't mean they'll work in the board of your fancy.

Q What's this I'm hearing about a consumer dual-processor platform from Intel?

A Responding to AMD's Quad FX and FASN8 enthusiast dual-processor platforms, Intel has come up with "V8," which offers support for two quad-core processors. Initial V8 rigs were nothing more than dual-Xeon motherboards, but Intel's "Skulltrail" is closer to what an enthusiast would want, offering SLI with up to four x16 PCI-E slots. The reason V8 can run SLI, while the X38 chipset cannot, is that it uses an Nvidia bridge chip similar to the one in the GeForce 7950 GTX single-card SLI boards. V8's handicap, however, is the requirement of pricier FB-DIMM RAM. Intel says newer FB-DIMM modules run faster and cooler than previous generations, but we're still not sold. Despite a new name and SLI support, Skulltrail is still a reworking of a workstation platform. The odd turn of events is that AMD might kill FASN8 due to lack of resources.

Intel Marches Onward to Nehalem

Intel calls it "tick-tock," but we call it hopscotch. First, there's a small jump, which is followed by a big, wiggle-your-ass broad jump. Penryn is the easy small jump. The ass wiggling will come in late 2008 when the company introduces its Nehalem family of CPUs. For Intel, Nehalem is proof that it ain't the same old chip company.

The old Intel couldn't bring itself to say that AMD was first. The new Intel is open to learning from AMD, and then doing it better. Nehalem finally drop-kicks the shared front-side bus topology of earlier dual-core chips for a chip-to-chip interconnect called QuickPath. Intel also moved the memory controller directly onto the die with three-channel DDR3. And Nehalem promises an open co-processor standard via QuickAssist using PCI Express. If all this sounds AMD-like, Intel doesn't mind.

As representatives of the company said at Intel's fall developer conference, Nehalem might sound rather Opteron-like, but it's only skin-deep, because the CPU will be far superior to AMD's offerings. Right now, it's just chest thumping that can't be trusted until the CPUs are in everyone's hands. But one key difference exists between AMD's Bulldozer talk and Intel's Nehalem talk: Intel has already demonstrated the new chip running an OS. That means the company is pretty confident it'll have Nehalem out by next year. AMD, meanwhile, doesn't expect Bulldozer until after the 45nm die-shrink at its Shanghai fab next year.

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Up Close and Personal

Putting the QX9650 to the Test

To test the 3GHz Core 2 Extreme QX9650, we used the new X38-based Asus P5E3 Deluxe motherboard with Corsair Dominator DDR3 RAM rated for operation at 1,800MHz (but operating at DDR3/1333), a 10K WD Raptor hard drive, and Windows XP SP2. First, we ran our benchmarks on the current speed champ: a 65nm, 3GHz Core 2 Extreme QX6850. Then, we swapped the proc for the 45nm QX9650.

Not all die shrinks have gone well for Intel. The shrink from the 130nm Northwood Pentium 4 to the 90nm Prescott Pentium 4 was a whoop-de-frickin'-do affair. Our reaction to this shrink is the exact opposite. To cut to the chase, we're damned impressed by the 45nm Core 2 Extreme QX9650. The new CPU is generally faster than its immediate predecessor, and when you factor in its overclocking capabilities and eventual performance bennies from SSE4, Intel has a real winner.

Of course, the performance spread depends on what benchmark or application you run. In our tests, we saw gains ranging from a modest 5 percent to a very good 15 percent when running at the exact same clock speed.

Most of the QX9650's big gains came in media encoding, where it was between 9 and 15 percent faster than the QX6850, running our standard benchmarks. We also saw good performance gains in applications tests and respectable 11 to 13 percent gains in gaming tests. Oddly, one test that Intel touts as being faster with the QX9650—the FEAR benchmark—showed no performance gains in our Lab when compared clock for clock.

Most notable is how well the QX9650 runs at higher speeds. Moving the QX9650 to 3.6GHz on a 1,600MHz front-side bus and DDR3/1600 speed RAM, we saw completely reliable performance (not one crash) using a stock Intel air cooler and stock CPU voltages. With tinkering, we're confident we could have seen 4GHz reliably. That's a good sign, as it has taken water cooling and voltage increases to get the 65nm part to the 3.7GHz range reliably. At 3.6GHz, we also saw the QX9650 cough up a 20 percent performance increase—right on par with the 20 percent clock increase in nearly every benchmark.

This amounts to a big win for Intel. Although some folks might be unmoved by seemingly "marginal" gains in a clock-for-clock test, they're missing the point. Penryn is designed for higher speeds. That it runs on air cooling with stock voltage at 3.6GHz only backs up our contention that Intel is intentionally holding back the new chip's performance because it doesn't have any competition right now. MPC

BENCHMARKS

CPU	Intel Core 2 Extreme QX6850	Intel Core 2 Extreme QX9650	Performance Difference	Intel Core 2 Extreme QX9650 Overclocked
CLOCK SPEED	3GHz	3GHz		3.6GHz
Synthetic Gaming				
3DMARK06 OVERALL	12,772	**12,888**	0%	13,284
3DMARK06 CPU	4,775	**5,049**	5.7%	5,935
3DMARK05 CPU	**18,012**	17,765	-1.4%	19,830
VALVE PARTICLE TEST (FPS)	103	**116**	12.6%	139
Gaming				
FEAR AT LOW RESOLUTION (FPS)	311	313	0%	410
QUAKE 4 AT LOW RESOLUTION (FPS)	204.9	**227.4**	11.2%	272.3
WORLD IN CONFLICT AT LOW RESOLUTION (FPS)	185	**205**	10.8%	240
Applications				
PREMIERE PRO 2.0 HDV (SEC)	1,577	**1,426**	10.6%	1195
PHOTOSHOP CS2 (SEC)	183	**178**	2.8 %	159
PROSHOW PRODUCER MPC TEST (SEC)	869	**821**	5.8 %	687
CINEBENCH 10	10,884	**11,798**	8.4%	14,216
BIBBLE LABS & NOISE NINJA (SEC)	1,740	**1,718**	0%	1,459
Encoding				
MAINCONCEPT REFERENCE AVC	1,661	**1,522**	9.1 %	1,271
AUTOGK XVID	418	**382**	9.4%	315
AUTOGK DIVX 6.7	416	**362**	14.9%	305
Synthetic application				
SCIENCEMARK 2.0	1,719.61	**1,803.14**	4.9%	2,154.19
VALVE MAP COMPILE TEST (SEC)	**132**	136	-2.9%	113
PCMARK2005 OV	9,665	**9,736**	0.7%	10,909
CPU	**9,658**	9,643	-0.2	11,587
MEM	6,517	**6,675**	2.4%	7,964
GPU	13,253	**13,495**	1.8%	13,876
HDD	7,019	**7,014**	0.1%	7,039

Our test platform includes an Asus P5E3 Deluxe Wi-Fi mobo, a 150GB Western Digital Raptor hard drive, 2GB Corsair DDR3/1800 memory, an Nvidia GeForce 8800 GTX videocard, a PC Power and Cooling Turbo-Cool 1,000 PSU, and Windows XP Professional. Best stock-clock performances in bold.

Benchmark Your PC without Breaking the Bank

The best way to see if your tweaks and upgrades have an impact on your system's performance is to run benchmark comparisons. Here's how you do it… for free!

TIME 22:00 HOURS:MINUTES

We run benchmarks at *Maximum PC* because we have to; there's no other way to determine the minute differences between systems without a repeatable standard of comparison. But you don't have to be a reviewer to run a benchmark; in fact, regular benchmarking can give you valuable insight into the status of your system. For example, benchmarks are the best way to decipher whether the various performance-enhancing applications you're running on your PC actually do anything or whether that latest batch of drivers hurt your gaming performance more than it helped.

The *Maximum PC* suite of benchmarks costs upwards of $1,000—a bit out of the price range of users who just want to see if their machines are up to snuff. But there are cheaper (and by that we mean free!) alternatives; we'll show you how you can use them to test your rig in the comfort of your own home.

BY DAVID **MURPHY**

WHAT YOU NEED

- **A PC**
- **CINEBENCH**
  www.maxon.net
- **3DMARK05**
  www.futuremark.com
- **CALL OF JUAREZ DIRECTX 10 DEMO**
  http://tinyurl.com/2g6dhr
- **HD TACH**
  www.simplisoftware.com
- **COSBI OPENSOURCEMARK**
  www.sourceforge.net/projects/opensourcemark
- **PRIME95**
  www.mersenne.org
- **PATIENCE**

Score Your CPU

We scoured the Internet and racked our brains to find the most appropriate (and most free) CPU test for your machine. And trust us, it wasn't easy. Whittling down the list of options to just those that are free was difficult enough—there's not much out there that will cost you absolutely nothing.

After picking through that small pile of programs, we discovered an important corollary that bears repeating: Just because a program claims to be a CPU test doesn't necessarily mean the score it generates is a proper reflection of your CPU's performance, particularly if you're running a multicore machine. (Single-core users have a bit more leeway with their CPU benchmark choices, as anything that taxes the CPU is going to hit your one, lonely core.) The surest way to test a benchmark's effectiveness is to pull up the Windows task manager while running a given CPU analyzer. A true CPU test will completely maximize the usage of all your cores.

Grab Cinebench and you'll be pleasantly delighted by its absurd ease of use and applicable testing environment. The program runs on everything from single-core to 16-core machines. It's a wonderfully future-proof little benchmark that gives you an overall performance score based on your computer's ability to render a 3D image in as little time as possible. You can even record your results to a built-in database, a helpful way to keep track of your scores when modifying your rig. If you're suffering any CPU performance loss as a result of your tweaking, Cinebench will let you know.

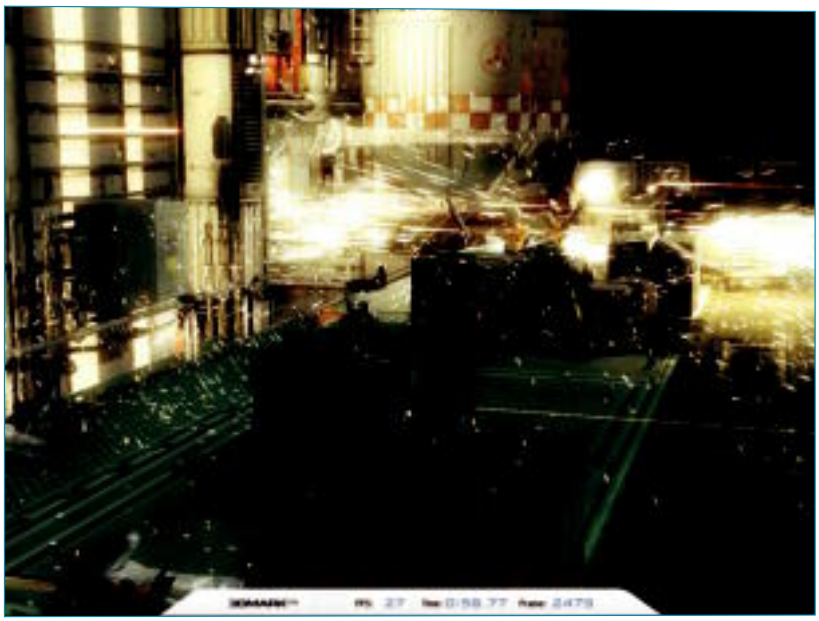
Cinebench's built-in database keeps track of all of your benchmark runs. Label everything correctly so you don't forget what changes you're testing!

Test Your DirectX 9 Performance

One of the surest ways to test your videocard's DirectX 9 performance is to—you guessed it—fire up a graphics-heavy game that includes a benchmark mode (like the FEAR benchmark we use in our Lab) and let 'er rip. But not every game tests your graphics card's performance. There's a reason we use Quake 4 *and* FEAR for our official benchmark runs: The former is an OpenGL-based game that's far more dependent on your CPU than your videocard, whereas the latter is a better demonstration of GPU-based prowess.

If you have no acceptable games to test your rig's performance, the next best thing is a free solution from Futuremark. Head over to the site and grab yourself the demo of 3DMark05. You might be tempted to download a later version for upgradeability's sake—don't. We've found that 3DMark05 pushes your graphics card more than later versions, which test the CPU a bit more.

Since the program's a demo, you won't get to edit any settings—you can't adjust antialiasing, the resolution, or anything else. However, 3DMark05 will scale depending on the power of your graphics card, and there are numerous websites and forums you can visit to compare your demo score to the scores other rigs achieve!



The 3DMark05 official score throws your CPU into the mix, but you can get adequate FPS results from the app's graphics-only tests.

Test Your DirectX 10 Performance

So you've plunked down big bucks for that fancy DirectX 10 card and you're curious whether all the different drivers, tweaks, and overclocks have had any effect. The best free benchmark we've found is a DirectX 10 demo from Call of Juarez. It runs through a series of in-engine settings that test everything from particle effects to HDR antialiasing to shadows.

As with any benchmark, you'll want to run multiple iterations of the graphical test to account for any errors or extraneous factors during the run. That said, the scores should be consistent, if not identical, across all three runs. If they aren't, double-check to see if there's anything eating up your computer's resources in the background!

To squeeze more frames out of your DX10 card, reduce antialiasing. Your images will get a little jaggier, but you'll see frame rates rise.

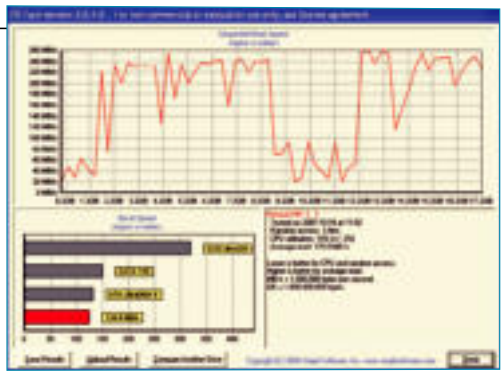
Benchmark Your Hard Drive

If you're looking for the source of slowdowns in your system's storage performance, the free HD Tach benchmarking utility is a must-have. With one click of a button, the application tests burst speeds, CPU utilization, random access speeds, and sequential read speeds.

The program gives you a ton of numbers once it's finished. The most important of these is the average read speed of your drive—it takes less time to pull data from the inside layer of a platter than the outer, hence the "average" in the calculation. On the whole, this number is a good measure of your drive's general performance.

HD Tach's burst speed measurement represents your drive's ability to transfer data from its onboard cache to your CPU. Higher numbers indicate faster file transfers. The random access measurement indicates the time it takes the drive to access a random sampling of data from all over the drive. In this case, a lower number is better.

There's not much you can do to improve the performance of a subpar drive. Check your BIOS to make sure you're running at the fastest interface speed possible—SATA 3.0 instead of SATA 1.5, for example. Defragmenting the drive might help, but performance degradation over the life of a drive might indicate hardware failure.

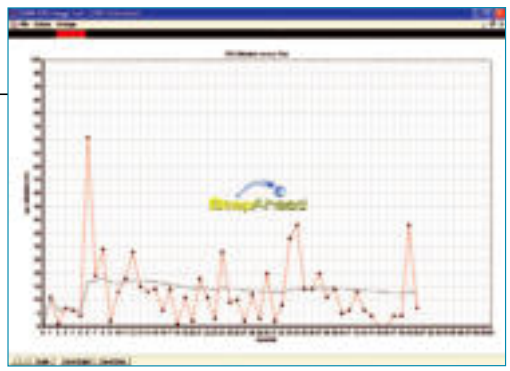


If you have two identical hard drives in your PC, a large disparity in benchmark results could indicate a faulty drive. Back up now!

Measure Your Overall System Performance

The open-source program COSBI OpenSourceMark attempts to replicate real-world benchmark scripts, similar to SysMark's and PCMark's. We've found that OpenSourceMark, which uses a number of real-world operations, is one of the better ways to analyze your computer. Install the program and click the "official run" button to start the tests—which include file compression, audio encoding, spreadsheet calculations, and image-editing activities. The program detects multiple cores and automatically reconfigures the benchmarks to take full advantage of your rig's hardware. And if you just want to test a particular subset of performance—say, file encoding—just select the "custom run" option and handpick your benchmark suites.

OpenSourceMark is a great way to test whether your computer tweaking is actually having a measurable effect on your system's performance. Do you really need to defragment your drive 12 times a week? How much does your antispyware program actually slow down your PC? What's the hard benefit of all that extra overclocking?



OpenSourceMark lets you save information about your CPU utilization to a text file.

Test Your Rig's Stability

Whether you've been overclocking an old rig to wring out more performance or you just purchased a new overclocked machine, stress testing your computer's stability should be high on your priority list. (Stock-clock users can join in the fun too, but it's not as critical. You can test whether a beta driver you downloaded mucks up your system in some capacity, but for the most part, a stock-clock machine should be inherently stable hardware-wise.)

An overclock can push a rig past safe (or stable) operation. You might not notice this instability or Windows might crash once an hour. Either way, one sure way to determine whether you've gone too far is to run your computer like a madman, and if it survives the rite of passage, you're golden.

We use Prime95 for stress testing in the Lab. In a nutshell, the program calculates new Mersenne prime numbers and taxes the heck out of your processor and RAM in doing so. If you're on a single-core machine, all you have to do is fire up Prime95 and select the Torture Test from the options menu. Run the test for 10 hours on small FFTs, which nails your CPU, before switching to large FFTs for the RAM.

Prime95 runs your PC at full loads until one of two things happen: You're content with your testing or your rig shuts down.

Owners of multicore machines will want to download the .zip version of Prime95 and extract its contents to a new folder for each core of your machine. Run the program out of each folder, which will open up one instance of Prime95 per core. Click "Affinity" on the program's advanced menu and set each instance to run on a different CPU core. Dual-core owners should run a small FFT on one core and a large FFT on the other; just double that equation if you're rocking a quad-core PC. MPC

Ask the Doctor

Diagnosing and curing your PC problems

BEEFING UP SOCKET 939

Vista is telling me that my PC's performance is bottlenecked at the CPU. I have top-of-the-line graphics with plenty of RAM and an AMD Socket 939 mobo with an FX-57 processor. I've looked at dual cores for my 939, but each core seems to be clocked lower than my FX-57, and I'm more interested in gaming than multitasking. With this in mind, could you tell me the best processor to put into Socket 939? I'd like this rig to last me at least another year or so.

—Blake Ogle

Microsoft Vista's performance scores look to the future, so they tend to skew in favor of dual- and multicore machines. Regardless of these scores, your 2.8GHz FX-57 is indeed the highest-clocked 939 chip. The problem? It's single core. A dual-core 2.6GHz FX-60 will still school it in most newer applications that support multithreading, and you'll likely be able to overclock the processor to 2.8GHz without problems.

The bad news is that FX-60s are pricey and difficult to find. If you want to go dual core, the cheap route is the Opteron 185—a Socket 939 2.6GHz Opteron with 1MB of L2 per core. It's basically an FX-60 without the FX. The main difference between the Opteron and the FX-60 is the level of multiplier locking—the former sticks you at 13x—and the reported lower thermals of the Opteron.

If you really want to future-proof your rig, you're best off saving your cash and investing in a sleek, new quad-core CPU. With more and more games promising multicore support, sinking your cash into a quad-core processor would be the best way to maximize the life span of your rig. Of course, that would entail purchasing a new AM2-based motherboard, as you won't be seeing any quad cores on 939 architecture.

RAIDING THE PEARLY GATES

I am a Roman Catholic priest, and I maintain a network of about 20 computers at the mission here. I want to have a RAID 1 array to boot from and a RAID 1 array for data. I don't want these four hard drives striped to each other in any way.

I want the boot drive protected by a mirrored array so that if one drive fails, the second can take over. I want the data stored in a mirrored array of drives for the same reason. One of those two mirrored data drives would be removable. Can what I want be done?

—FronW

What you ask for might be possible, depending on the RAID implementation on the card or motherboard. On an Nvidia nForce 680, for example, you can build two separate RAID 1 arrays using four drives. The RAID controller will identify each drive that you add to an array.

Your plan to swap out the drives could work, but it's hardly an ideal backup scheme since a mirrored RAID should never be considered synonymous with a system backup. Remember, a mirrored array creates two duplicate hard drives in every sense of the word: If a virus hits your system, that virus will exist on both drives in your array. The same holds true if you accidentally delete a file.

If one drive in a mirrored array fails, you just have to replace it with another drive and the array will rebuild itself back up to a two-drive protected entity. While that's happening, the odds of the single healthy drive failing are rather low. But if you're truly worried, you might want to lump all of your drives into a single RAID 6 array. That way, any two drives can fail and you'll still have a working system and all of your data intact.

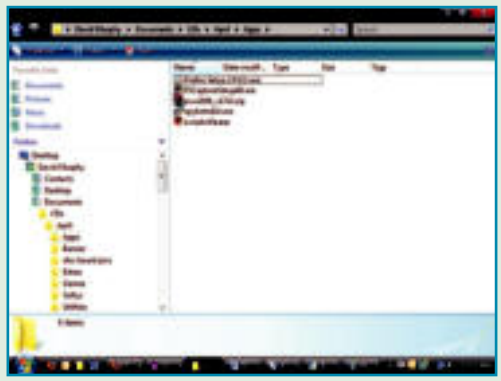
STRUGGLING WITH SLI

How do you go about updating SLI videocard drivers? I have two GeForce 7950 videocards in SLI mode. I have refrained from updating the drivers until I first get some advice. What I think you have to do is uninstall the drivers from both cards and then install the drivers one at a time with reboots and then tell the cards to rebuild the SLI with one the master and one the slave? Is this correct?

—Rob Carver

Updating an SLI configuration is exactly the same as updating drivers on a single videocard. The Doctor suggests you first reboot your rig into safe mode and uninstall your videocards' current drivers. To do that, pull up the Windows device manager, expand the Display Adapters menu, right-click each card, and select Uninstall. Next, restart your computer.

Your screen will probably look a bit wonky or Windows may try to find and reinstall your card's drivers. Don't let it. Grab the latest 7950 drivers from Nvidia.com and double-click the executable to install them. Allow the program to restart your computer. When your OS reemerges, you might have to set your display resolution back to its normal setting, and you'll surely have to re-enable SLI for your videocards in the Nvidia control panel. But you'll now be running the latest drivers, and happiness will ensue.



After you uninstall your videocard drivers, your computer will default to a generic VGA mode, which looks like this: ugly and huge.

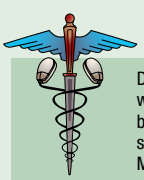
GO, GO MOBO! GO!

I own a Compaq Presario desktop with an AMD Sempron 3400+ CPU. I want to upgrade to an Athlon 64 X2 CPU, but I first need to upgrade my motherboard. Will replacing the mobo nuke the factory-installed copy of Windows XP?

—Dylan Winn

Replacing a motherboard will do nothing to the contents of your hard drive—where Windows XP is installed. You could throw your motherboard off a balcony, buy a new motherboard of the same variety, put your computer back together, and everything would be peachy keen.

That said, when you replace your motherboard, you'll want to reinstall XP. In fact, it's not really a "you'll want to" issue so much as it is a "Windows won't boot" issue. So before your machine is in pieces on the floor, don't forget to back up your important data! MPC



Doctor. From *Maximum PC*, sweet Doctor. Would you please hang out with me? He works across the street up on the third floor of the Shoreline building. I saw him in his Lab, practicing his fixes. I knew you might just send him a computer question to doctor@maximumpc.com. Doctor. From Maximum PC… he's the Doctor extreme!

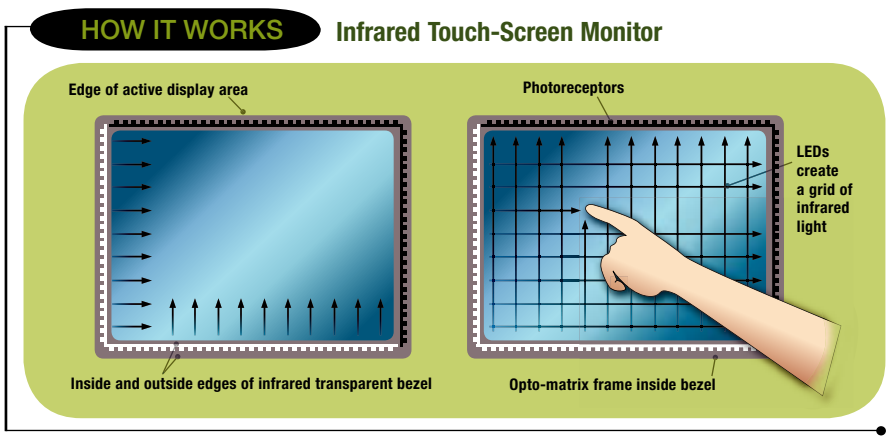
White Paper: Touch-Screen Technology

How new displays put the world at your fingertips.

BY ZACK **STERN**

Touch screens may never replace our clicky-clacky QWERTY keyboards—no, we'll have to wait for brain-stem probes for that—but they are becoming more common. In fact, devices using this technology have been in use for more than 35 years and are becoming ubiquitous—kiosks, tablet PCs, desktop computers, and many handheld devices all now rely on human touch.

While the end result is the same—a display surface maps the coordinates of an input—touch screens rely on different phenomena to perform their functions, ranging from electrical current to infrared light to sound waves.



A frame around the display houses LEDs and photoreceptors on opposite sides. The LEDs emit light, which is detected by the photoreceptors. The display identifies X and Y coordinates when the user's fingertip blocks one or more of the beams.

RESISTIVE VERSUS CAPACITIVE

A resistive touch screen sandwiches several thin, transparent layers of material over an LCD or CRT. The bottom layer transmits a small electrical current along an X and Y path. Sensors monitor these voltage streams, waiting for an interruption. When the flexible top layer is pressed, the two layers connect to form a new circuit. Sensors measure the change in voltage, triangulating the position to X and Y coordinates.

Resistive touch screens work with any kind of input, including a stylus or finger, and they're usually very inexpensive to manufacture. They're less durable than other types of touch screens, however, because the topmost layer experiences a great deal of wear from physical contact and constant flexing. Longevity isn't a big problem for tablet PC and PDA deployments—two of the most common applications for resistive technology—but it can be for public kiosks, which are expected to endure more than 35 million impacts over their lifetimes.

Capacitive screens move the electrical layer to the top of the display. A minimal current is broadcast and measured from the corners of the monitor. When a person touches the screen, a small amount of the current is drawn away by the body's natural capacitance. The sensors measure the relative loss of the current and a microcontroller triangulates the point where the finger made contact.

Capacitive screens are more durable than resistive screens because their top layers are fabricated from rigid glass. They are typically easier to read because thin layers of material aren't on top of the display surface. The need for a live fingertip, however, often makes them feel less accurate to the end user than a stylus-driven interface. Trackpads and handheld devices, such as Apple's iPod Touch and iPhone, commonly use capacitive input.

SURFACE ACOUSTIC WAVE

Surface acoustic wave (SAW) screens use beams of ultrasonic waves to form a grid over the surface of a display. Sensors along the X and Y axes monitor the waves; when one is broken, the X and Y points are combined to identify the touch coordinate.

SAW screens, like their capacitive counterparts, are durable and provide a clear line of sight to the display image, but the former work with any kind of input, be it a fingertip, a fingernail, or a stylus. On the other hand, they're more susceptible to interference from dirt and other foreign objects that accumulate on the screen, registering surface contaminants as points of contact.

INFRARED AND INFRARED IMAGING

Infrared touch screens are similar to SAW screens in that they use a ring of sensors and receivers to form an X/Y grid over a display. But instead of sending electrical current or sound waves across this grid, infrared LEDs shoot invisible beams over the surface of the display. The microcontroller simply calculates which X and Y lines were broken to determine the point of input.

These screens work with a stylus, finger, or other pointer and give an unobstructed view of the display. They're also durable because the point of input is registered just above the glass screen; only incidental contact is needed. Military applications often use infrared screens because of the product's longevity.

Infrared imaging touch screens are vastly different from touch screens that use traditional infrared input. IR imaging screens use two or more embedded cameras to visually monitor the screen's surface. IR beams are transmitted away from the cameras, illuminating the outside layer of the display. When the beams are disrupted by a fingertip or a stylus, the cameras measure the angle of the object's shadow and its distance from the camera to triangulate the disruption.

IR imaging allows a direct view of the display. And since the input is registered just above the glass, physical contact is not required to initiate action. HP's TouchSmart IQ770, one of the first mass-market touch-screen computers designed for the home, features this technology. HP markets the TouchSmart as an in-home kiosk that families can use for quick tasks without necessarily having to rely on the mouse and keyboard for navigation.

ACOUSTIC PULSE

While all the other touch-screen technologies rely on transmitting a wave or current, acoustic pulse screens just listen, literally. Two or more receivers are mounted at the edges of the screen to monitor contact. The tap of a finger, stylus, or other pointer makes a small sound vibration, which the display then triangulates. Based on the relative volume of the sound and other factors, the display can quickly determine where on the surface the input occurred. These types of touch screens are particularly useful in public kiosks, not because they're impervious to surface scratches, but because the scratches don't interfere with the screen's ability to detect contact.

TOUCH THE FUTURE

Capacitive and resistive touch screens will likely continue to be the most commonly implemented technologies because of their low cost. They can even be combined into a single display, producing ideal fingertip or stylus input depending on the situation. However, we expect optical tracking to become more common because of its accuracy and flexibility.

Microsoft's newly released Surface PC hides IR cameras beneath a tabletop screen. These cameras work similarly to IR imaging systems, but they monitor display interactions from below instead of from the side. This perspective allows the computer to visually identify input, offering a different interface depending on what is placed on the screen.

Surface, and other new displays are also embracing multitouch input. (The iPhone brought multitouch to the masses, although the technology has existed for 25 years.) Since the Surface PC can identify multiple fingers, it can let more than one user operate it at a time. Or single users can use multi-finger gestures to resize and manipulate items on the screen.

Nearly any of the touch-screen technologies can use multitouch input; however, some need additional sensors to help triangulate simultaneous inputs. The iPhone and the iPod Touch, for example, use a capacitive touch screen with coordinate-based inputs versus axis-based inputs. This allows two touches along the same axis—which would cause problems with certain capacitance touch-screen designs—to be registered as independent points of contact.

While the technologies may differ, we look forward to touch screens filling up walls and tables in our homes and offices. At that point, simple, direct interaction will beat traditional input methods. Who wants to carry a mouse around the house when a personal touch will do? MPC

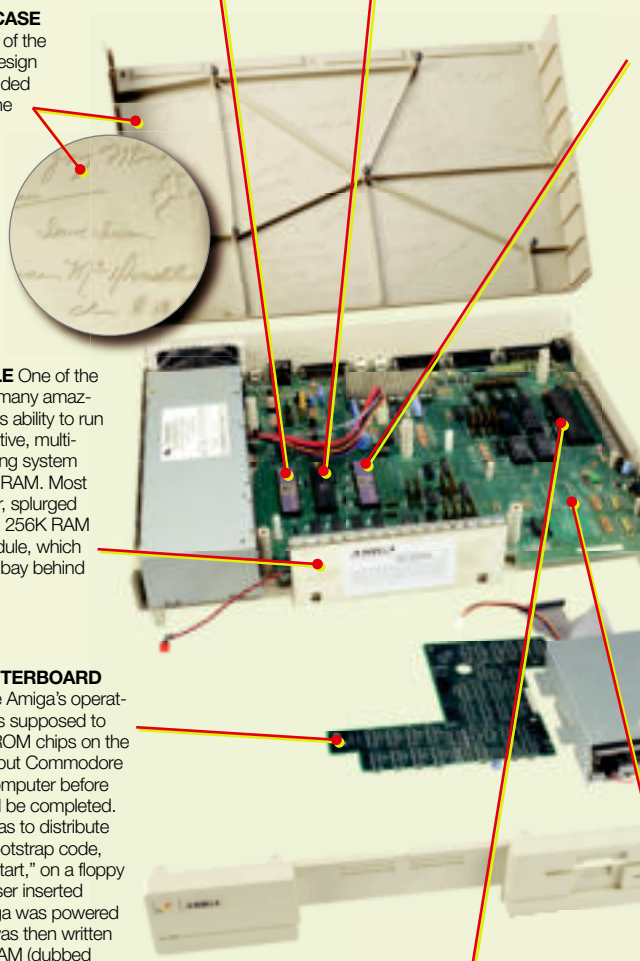
Amiga 1000

If life were fair—and if Commodore's management hadn't been such bumbling fools—this magazine would likely be called *Maximum Amiga.* The Amiga 1000, introduced in 1985, was one of the world's best early personal computers.

DENISE This was the Amiga's main video processor. The NTSC version was capable of producing up to 32 unique colors at one time from a palette of 4,096 at 320x200 resolution. The chip could display all 4,096 colors simultaneously in a special mode known as "Hold and Modify." Denise also controlled mouse and digital joystick input.

AGNUS Agnus controlled access to "chip" RAM from the CPU and the other custom chips. Chip RAM differed from "fast" RAM in that the CPU and the custom chips could perform DMA transfers to and from chip RAM. Only the CPU could access fast RAM.

ENGRAVED CASE The signatures of the entire Amiga design team were molded into the lid of the Amiga 1000.



PAULA This chip's primary function was to produce audio. It was capable of generating four independent 8-bit PCM sound channels simultaneously. Paula also handled I/O functions, including the Amiga's floppy drive, serial port, and analog joysticks.

RAM MODULE One of the Amiga 1000's many amazing traits was its ability to run a fully pre-emptive, multitasking operating system in just 256K of RAM. Most users, however, splurged for the optional 256K RAM expansion module, which plugged into a bay behind the front panel.

WCS DAUGHTERBOARD The core of the Amiga's operating system was supposed to be burned to ROM chips on the motherboard, but Commodore shipped the computer before the code could be completed. The solution was to distribute the Amiga's bootstrap code, dubbed "Kickstart," on a floppy disk that the user inserted when the Amiga was powered up. Kickstart was then written to 256KB of RAM (dubbed "writeable control storage") on a daughterboard; this RAM was then write-protected so that Kickstart was retained even after a warm boot.

CPU The Amiga 1000 featured a Motorola 68000 microprocessor running at 7.16MHz, but it was augmented by three custom chips—Denise, Agnus, and Paula—that offloaded nearly all graphics, animation, and audio work.

"MISSING" KICKSTART ROM Since the contact points and traces for the Kickstart ROM were on the motherboard, some Amiga 1000 owners modified their machines by adding Kickstart ROMs.

Any requests? What hardware—new or old—would you like to see go under *Maximum PC's* autopsy knife? Email your suggestions to **input@maximumpc.com.**

GORDON **MAH UNG**

Introduces New System Benchmarks

The yardstick we use to measure review systems just got updated

EVGA's nForce 680i SLI board marks the fourth Nvidia-based chipset that we've adopted for our zero-point systems.

It's been a long time since the zero-point system and benchmarks we use to test PCs and other components have been updated, and it shows. The enthusiast world has switched from AMD to Intel and a new OS is upon us.

To select our new hardware and benchmarks, a committee of editors sat around a box of doughnuts and debated the direction of performance computing. We discussed the typical tasks power users perform and how we could make our benchmarks pertain to those needs. Then, we discussed what PC configuration to use to test all new hardware in the coming year. Our zero-point rigs represent the basic level of hardware we expect a power user to have six months from now. These machines serve not only as a reference point for readers of our system reviews but also as test beds for almost all the hardware and software we review.

Generally, we update our zero-point config and all our benchmarks every 12 to 18 months, but this time, we're breaking from convention. We're sticking with old gaming benchmarks for the time being. Why? With high-profile titles like Crysis on the cusp of release, we decided to continue running Quake 4 and FEAR benchmarks until newer, more graphically intensive DirectX 10 titles are available. At that time we'll fold those tests into our benchmark suite.

A pair of EVGA 8800 GTX boards gives our machine potent gaming capability at all resolutions.

The Hardware

Although considered high end by most, our zero-point system really stacks up as a midrange machine

CPU

When we spec'd our new test machines, we decided quad core was a must-have feature. We would have considered both AMD and Intel, but as you know, AMD is a no-show in the consumer quad-core game. We normally reach for the top-tier CPU, but this year, we selected a CPU that most enthusiasts on a budget would buy, not what we all want. Intel's fast, new QX9650 was out of our price range, so the company's Core 2 Quad Q6700 got the job. At $500, it's pricey but not a wallet breaker. For our zero-point, we'll run it at its stock 2.66GHz clock even though we know it'll run at 2.93GHz all day without breaking a sweat.

MOTHERBOARD

EVGA's 680i SLI will soon be supplanted by Nvidia's follow-up to the chipset, but we've chosen it for its affordability and proven ability as a workhorse. Plus, BIOS updates from Nvidia have been timely and the chipset supports SLI. *Maximum PC* historians will note that the 680i SLI is the fourth generation of nForce chipsets we've adopted since we stopped being an Intel-only chipset shop.

VIDEOCARDS

The best-performing card right now is EVGA's GeForce 8800 Ultra, which sells for more than $700, making SLI cost prohibitive. That's why our machine uses a pair of EVGA GeForce 8800 GTX warhorses. The duo gives us smooth performance at just about any resolution you'd play games at.

MEMORY

8GB? 4GB? Nah. Within the limitations of a 32-bit OS, the sweet spot for system RAM is sadly still 2GB. To meet our zero-point system's needs, we reached for 2GB of Corsair DDR2/800 Dominator 8500C5D modules. The modules are rated to run at 1,066MHz, which will be useful when an individual machine has to be overclocked to test cooling gear.

HARD DRIVES

Because we constantly wipe our test beds with a clean hard disk image, we're eschewing a RAID setup (disk imagers work inconsistently with RAID). We didn't want to totally give up on performance, though, so our main boot drive is a single 10,000rpm 150GB Western Digital Raptor drive. A supplemental 7,200rpm 500GB WD Caviar pulls bulk-storage duties for holding drivers, benchmarks, and image files.

OPTICAL DRIVES

Burning Blu-ray and HD DVD discs isn't critical for every editor, but viewing high-resolution movies is an important part of testing many products. With that in mind, we reached for LG's GGC-H20L drive, which

reads both Blu-ray and HD DVD discs and gives us DVD and CD burning capability. The drive has a SATA interface and will likely mark the end of PATA in our Lab.

SOUNDCARD

As good as the EVGA 680i SLI boards are, they still use Realtek's onboard audio, with its fake-ass EAX support. To fill the void, Creative Labs's X-Fi XtremeGamer gives us hardware audio support in XP (and the Vista drivers almost work too!).

POWER SUPPLY

We've long used PC Power and Cooling's PSUs in our zero-point machines. In almost 10 years of testing, we've had only one supply ever fail, and that was due to impact damage that no editor ever owned up to (Josh!). In a shocking move, we're stepping back from our previous test bed's insanely high wattage in favor of a quieter Silencer 750 quad supply.

The Benchmarks

Our benchmarks continue to be 100 percent synthetic-free tests. If a machine gets faster scores in our benchmarks, it's because it's faster, not because of an esoteric driver hack

ADOBE PREMIERE PRO CS3

We decided to reuse much of our project from the previous Premiere Pro 2.0 benchmark suite, but we've upgraded to Premiere Pro CS3. Additionally, we've tweaked our output options. Instead of outputting the file to WMV9, we take our HDV-res video and spit it out to a 1080i Blu-ray-compatible file in MPEG-2 format. The project continues to use multiple effects, both CPU and GPU, and multiple video overlays. The benchmark really highlights the improved multithreading support in CS3. The test favors fast CPUs and scales well with clock speeds, but not as much when you move beyond four cores.

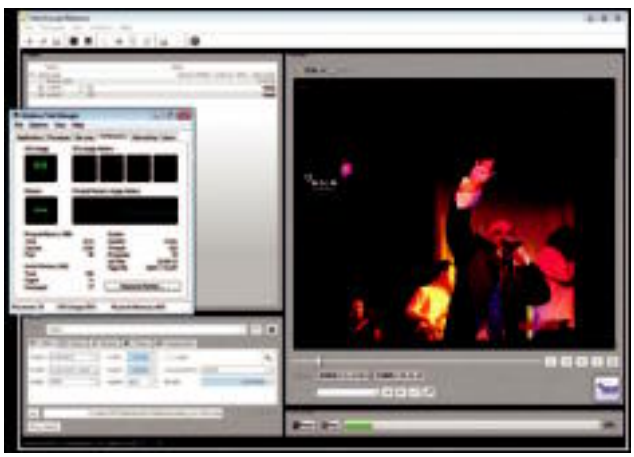
ProShow is one of the top choices for professionals who want to make video slideshows from their still images.

ADOBE PHOTOSHOP CS3

The only major change to our Photoshop test is the jump from CS2 to CS3. For this benchmark, we take a RAW file (shot with a 12MP Canon EOS 5D) and apply a ton of filters to it with multiple reverts along the way. Our Photoshop script tends to be CPU intensive, but disk I/O and the amount of system RAM also influence the result. Multicore support in Photoshop is better than in previous versions, but for the most part, this benchmark prefers clock speed over the number of cores.

PHOTODEX PROSHOW PRODUCER

New to our benchmark retinue is Photodex's popular ProShow Producer application. The application is a popular slideshow program among professionals and advanced amateurs. We like it because it not only represents real-world workloads but is also extremely multithreaded and will even load up a dual quad-core machine. In our benchmark, we build a slideshow using 130 12MP images shot with an EOS 5D at 3200 ISO. We apply a random selection of transitions and effects to the images and two MP3 files are used for background music. The entire show is then rendered as a 1080p MPEG-2 file. The benchmark likes clock speed and gets a good bump from quad-core CPUs, but our tests show that Intel's eight-way Xeon platform doesn't scale as well as we'd expect.



MainConcept is a popular multithreaded codec maker that's embedded in many consumer and commercial applications.

MAINCONCEPT REFERENCE

Also new to our benchmark suite is MainConcept's Reference. You might not be familiar with the MainConcept name, but you probably use one of its products. Corel, Adobe, and AverMedia all use MainConcept's codecs. We use MainConcept's freely available Reference demo to transcode the 1080p MPEG-2 file created in our ProShow Producer benchmark to the AVC/H.264 codec at 1920x1080 resolution. The Reference demo uses the same codec as the fully licensed version but includes a watermark in a corner. The benchmark gets a healthy bump from quad cores and scales well with clock speed. Interestingly, this is one of the few benchmarks that run significantly faster under Windows Vista than XP.

FEAR

FEAR: First Encounter Assault Recon was a punishing game and benchmark when it shipped two years ago, but it's no match for today's hardware. It is still very much a GPU benchmark at higher resolutions, but at 1600x1200, a combination of GPU and CPU influence the score. As a compromise, we run FEAR's demo with soft shadows enabled and 16x anisotropic filtering. Hardware audio support, if available, is enabled for the benchmark runs as well. We'll be replacing FEAR with a more current game within the next three issues.

QUAKE 4

This venerable Doom 3–engine game is OpenGL-based and generally exposes poor OpenGL drivers. We run our custom timedemo at 1600x1200 with 4x AA and 4x anisotropic filtering. The game is one of the first to support dual cores and it scales well with CPU support. We'll also be replacing this benchmark within the next three issues.

How the New Zero-Point Stacks Up

Windows XP isn't going away, so our new benchmark suite supports both OSes, but the speed differences are surprising

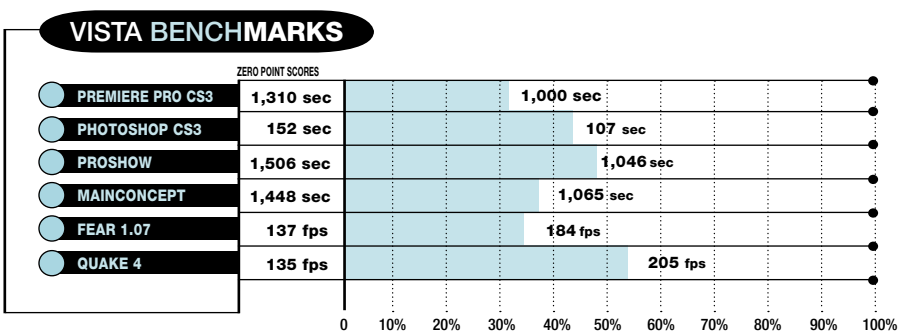
We selected all of our benchmarks because they run on both Windows Vista and Windows XP Professional. As performance hounds, we lean toward Windows XP Professional, so we considered running our benchmarks in XP and simply comparing Vista-only machines that we receive on the same scale. After lengthy debate, we decided that would be unfair, so our zero-point is a dual-boot system with Windows XP Professional SP2 and Windows Vista. We ran the benchmarks on each OS independently.

Wonder why enthusiasts are skipping Vista? Look at our benchmark chart. Vista performance generally dragged behind XP except in two tests: FEAR and MainConcept. We were particularly surprised by FEAR. Vista drivers have been horrible since launch, but apparently Nvidia has finally turned a performance corner.

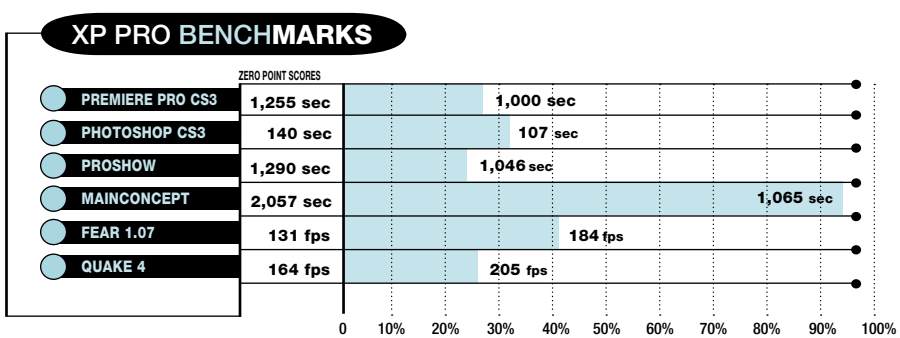
There's no such speed increase elsewhere, though. ProShow Producer showed a 14 percent performance decrease in Vista, and Photoshop was about 8 percent slower. OpenGL performance was atrocious in Vista, as well, with Quake 4 scores about 18 percent slower than XP's. Ouch.

How does the new zero-point stack up against a high-end machine? You can read this month's system review on page 76 for details, but a faster CPU, RAID 0, and faster graphics cards amounted to as much as a 50 percent increase in performance. Our zero-point machine is not intended to best the machines we review but to provide a frame of reference for readers who wonder just how fast a 4GHz Penryn is compared to what's in their own rigs. MPC

We use the same HDV content we previously used, but now we're outputting it to a Blu-ray-friendly MPEG-2 format instead of WMV.



Our current desktop test bed is a Windows Vista Ultimate machine using a quad-core 2.66GHz Intel Core 2 Quad Q6700, 2GB of Corsair DDR2/800 RAM on an EVGA 680 SLI motherboard, two EVGA GeForce 8800 GTX videocards in SLI mode, Western Digital 150GB Raptor and 500GB Caviar hard drives, an LG GGC-H20L optical drive, a Sound Blaster X-Fi soundcard, and a PC Power and Cooling Silencer 750 Quad PSU.



Our current desktop test bed is a Windows XP Professional machine using a quad-core 2.66GHz Intel Core 2 Quad Q6700, 2GB of Corsair DDR2/800 RAM on an EVGA 680 SLI motherboard, two EVGA GeForce 8800 GTX videocards in SLI mode, Western Digital 150GB Raptor and 500GB Caviar hard drives, an LG GGC-H20L optical drive, a Sound Blaster X-Fi soundcard, and a PC Power and Cooling Silencer 750 Quad PSU.

AVADirect Core 2 Duo SLI Gaming System

Blood and thunder!

Pretty lights abound on the AVADirect Core 2 Duo SLI Gaming System.

Our first thought upon opening AVADirect's new Core 2 Duo SLI Gaming System was, "Wow, this is heavy." Our second, "Oooh, but it's pretty!" was followed shortly by a third, "It's *bleeding!*" A cursory inspection revealed that the system was shipped without one of its two CPU-cooler hose clamps, and was indeed leaking AVA's "bloody red" coolant into the machine. Disconcerting, to say the least. We notified AVADirect of the problem, and they dispatched a tech to fix it. Thereafter, despite some red residue on one of the 8800's DVI ports, the rig worked perfectly.

Aside from this initial gaffe, the AVADirect impressed us with its build quality. The first thing we saw when we opened the SilverStone Temjin TJ07 case was a sprawl of water-cooling tubes running to both GPUs, the RAM, and the CPU. The aforementioned "bloody red" cooling fluid is augmented by four red cold-cathode tubes along the sides of the acrylic window, lending a fearsome aspect to the rig's innards. Cables and wires were neatly routed along the inside of the case, but certainly not as neatly as in last month's HP Blackbird. The modular 1,200W Thermaltake Toughpower PSU provides a ridiculous amount of power while remaining mostly hidden beneath a partition at the bottom of the case.

AVA certainly makes good use of the Temjin's seven 5.25-inch external drive bays; the first two hold an ArctiCool white-on-blue LCD that displays system stats like drive space, CPU, and RAM utilization, as well as a faux-analog clock. The next bay holds a Pioneer Blu-ray reader/DVD burner combo drive. Two more drive bays contain the Koolance reservoir pumps that drive the liquid-cooling system and display per-reservoir fluid temps, leaving just two bays free.

Does this mess o' tubes make a difference? Yep! The max idle temperature was 35 C, and during our stress tests no core got above 72 C. Not shabby. And other than our initial leakage issue, the cooling system is very neatly installed, routed, and configured. There are no wasted pipes, and the whole thing looks terribly impressive. Maybe too impressive. While we appreciate the thought, most folks would probably agree that water cooling is overkill for some of the components—we're looking at you, overclocked RAM.

AVA overclocked this machine to the nines. The Intel Core 2 Extreme QX6850 CPU is running at 3.67GHz, up from 3.0GHz, the dual EVGA e-GeForce 8800 Ultras are "superclocked" to 655MHz, and even the OCZ RAM is ratcheted up to 1150MHz. We tested the rig with our Prime95 stress test, and detected no stability problems.

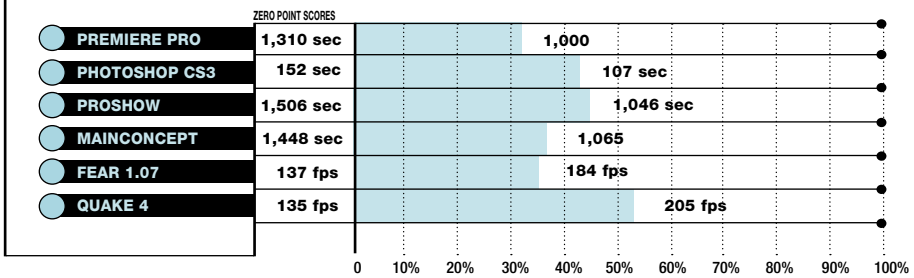
The overclocking shows, too. Despite shipping with Vista (a questionable choice), the AVADirect blazed through our FEAR benchmark at 184fps, faster than any other rig we've tested. Its Quake score was a respectable 205fps—nearly twice as fast as the Blackbird, and right up there with the fastest XP rigs we've seen. What can we say, except that Nvidia's OpenGL driver, even in Vista, is still better than AMD's. Performance was top-notch and easily bested our new quad-core zero-point system (see page 70)—no surprise, as the AVADirect box sings along at clock speeds 1GHz higher. Our point of reference against other rigs is blank, as this is the first machine tested using our new benchmarks. We did, however, run our old Photoshop CS2 script on the AVADirect, and while it's fast, the rig's scores were a bit slower than those of the recently reviewed Dell and HP PCs.

The rest of the AVADirect's hardware is just as high-powered, if not exactly what we expected. The Asus Xonar D2 soundcard sounds great and includes color-coded backlit inputs and plenty of ports, but no hardware processing. This is the first

UNDER THE HOOD

BRAINS	
CPU	Intel Core 2 Extreme Quad QX6850 (3.0GHz overclocked to 3.67GHz)
MOBO	Asus Striker Extreme, nForce 680i SLi
RAM	2GB OCZ Liquid Ready Edition DDR2/1150
LAN	Dual Gigabit LAN
HARD DRIVE	Two 150GB Raptors (10,000rpm SATA) in RAID 0
OPTICAL	Pioneer BDC-2202
BEAUTY	
VIDEOCARD	Two 768MB eVGA e-GeForce 8800 Ultra in SLI
SOUNDCARD	Asus Xonar D2
CASE	Silverstone Temjin TJ07
BOOT: 58 sec.	DOWN: 24 sec.

VISTA BENCHMARKS



Our current desktop ted bed consists of a quad-core 2.66GHz Intel Core 2 Quad Q6700, and 2GB of Corsair DDR2/800 RAM on an EVGA 680 SLI motherboard. We are running two EVGA GeForce 8800GTX cards in SLI mode, Western Digital 150GB Raptor and 500GB Caviar hard drives, LG GGC-H20L, Sound Blaster X-Fi, and PC Power and Cooling Silencer 750 Quad. OS is Windows Vista Ultimate

A missing hose clamp resulted in a coolant leak during shipping, but the vendor's tech promptly replaced it.

rig we've tested in a while that shipped with a dedicated soundcard other than a SoundBlaster X-Fi; most rigs, if they eschew Creative, opt for onboard audio. It's a relief not to have to listen to RealTek audio.

The 150GB Raptors in RAID 0 are speedy but will leave system owners walking the high-wire without a net since there's no backup drive. Would a simple terabyte drive have hurt, guys? And why not install XP while you're at it? The AVADirect box is the first to impress us with its almost XP-like gaming performance, but let's face it, gaming and Vista are still an odd couple. Another letdown: Where's the Penryn? When the company said it was shipping us a "next-gen" box, we thought it would include Penryn and Nvidia's G92, but the machine included a 1,333MHz Kentsfield CPU and GeForce 8800 Ultras. Hardly next-gen.

Despite these quibbles, we were generally impressed with the system's stability and performance. The horror of a leaky water-cooling system was ameliorated by the quick corrective action taken by AVADirect's optional on-site tech support.

While we wouldn't necessarily buy this exact configuration, we'd definitely go to AVADirect for their nigh-infinite customizability, good build quality, and excellent tech support.

—NATHAN EDWARDS

AVADIRECT CORE 2 DUO SLI

DIRECTOR'S CUT
Solid build; great tech support; high performance.

DIRECT TO DVD
Shipped with Vista; no backup drive; the leak hurts the final score.

7

$6,770, www.avadirect.com

Showdown at the Terabyte Corral

Western Digital and Seagate join the fray, and they're packin'!

Who doesn't love a healthy dose of 1,000GB in a single storage medium? We sure do, but even more than that, we love competition. The first terabyte drives from Western Digital and Seagate arrived in our Lab within days of each other, and we immediately set out to see if either one could unseat the current terabyte king: Hitachi's 7K1000. Read on to discover what happens when the cutthroat world of extreme storage meets the cutthroat testing of the Maximum PC Lab.

—DAVID MURPHY

WESTERN DIGITAL CAVIAR GP

We've been waiting with bated breath for Western Digital's entrance into the world of the almighty terabyte. Its Caviar GP drive may have lost the right to stand at the top of the market and yell, "Firsties!" but it is the only terabyte drive built with energy-savings in mind.

The four-platter drive features a number of functions that aim to reduce the drive's total power consumption: The drive modulates its rotational speeds between 5,400rpm and 7,200rpm, unloads the heads when the drive is idle, and smooths out the normally jittery motions of the actuator in an attempt to minimize wasted juice.

Western Digital hopes DIYers are willing to sacrifice a little speed to save the environment—and some cash.

It sounded like junk science to us too, until we compared the power-consumption levels of a Caviar GP–based rig to those of an identical setup that uses Hitachi's 7K1000. A power analyzer confirmed that our Caviar GP rig drew from 7 to 10 fewer watts on average. For a computer that runs at idle all day long, that translates to about 61.32 kilowatt-hours per year. Assuming you're paying roughly 10 cents per kilowatt hour, a Caviar GP could save you about $6 a year—just enough for a feast at Taco Bell.

The Caviar GP holds its own performance-wise. As expected, though, the drive's emphasis on power-saving costs it a little bit in the speed department. Although improved areal density over Hitachi's 7K1000 helps bridge the gap between the two drives, the Caviar GP still falls short of the 7K1000's impressive read speeds. Of the three terabyte drives we've tested, the Caviar GP is the slowest by far.

POWER CONSUMPTION

	WD CAVIAR GP	HITACHI 7K1000
IDLE (W)	**144**	151
BURST (W)	**147**	152
RANDOM ACCESS (W)	**149**	160

Best scores are bolded. All voltage measurements taken using an Extech Power Analyzer.

WD DIGITAL CAVIAR GP

7

SAVE THE WHALES

You save electricity with this drive, which makes you feel like an environmentally conscious all-star.

SHAVE THE WHALES

You really aren't saving that much energy, and you're sacrificing quite a bit of speed.

$330, www.wdc.com

SEAGATE BARRACUDA 7200.11

With new teams entering the terabyte storage market, it was only a matter of time before one smacked down the great Hitachi 7K1000 1TB drive. That distinction goes to Seagate's 1TB Barracuda 7200.11 drive.

The Barracuda and Western Digital's Caviar GP are virtually identical in terms of features: same 32MB cache, same 7,200rpm rotation speed, same 512 bytes per sector. The Barracuda and Caviar GP drives also use four platters (250GB apiece) to hit their 1TB capacities, unlike Hitachi's 7K1000, which uses five platters. This difference in areal density proves to be a fatal flaw for Hitachi's drive, and the Caviar GP's speeds are constrained by its focus on energy savings.

The result? Seagate's 7200.11 terabyte drive is the fastest we've yet tested in the Lab, hands down. It doesn't come with any additional features—no encryption, no power-savings, no backup—just speed. Although we'd welcome the others, speed is our primary concern.

Unconstrained by power-saving techniques, Seagate's Barracuda delivers speed, speed, and more speed—but no extra features!

BENCHMARKS

	WD CAVIAR GP	SEAGATE 7200.11	HITACHI 7K1000
BURST (MB/S)	**214.4**	131.3	206.9
RANDOM ACCESS (MS)	14.9	**12.7**	13.1
AVERAGE READ (MB/S)	66	**86.6**	72.7

Best scores are bolded. All benchmarks taken using HD Tach 3.0.1.0. Power Consumption

SEAGATE BARRACUDA 7200.11

9

FRIJOLES

You're staring at the fastest terabyte drive on the market.

AY CARAMBA

The Barracuda's burst speeds aren't quite on par with Western Digital's. That's a minor detail, but a detail nonetheless.

$330, www.seagate.com

Gateway XHD3000

Finally, a 30-inch LCD that's made for power users

While the major monitor manufacturers were busy churning out the status quo, Gateway was pushing the envelope.

When we reviewed 30-inch desktop LCD monitors from Dell, HP, and Samsung back in May 2007, we were left saddened by the large-screen state of affairs. These monstrous widescreens offering unparalleled 2560x1600 resolution seemed like the perfect fit for power users—if not for their inherent limitations. Unlike high-performance desktop LCDs of lesser size, these 30-inch panels lack an internal scaler (and Apple's 30-inch Cinema Display is no different). The problem is that conventional monitor-scaling technology isn't powerful enough to drive these screens' 2560x1600 pixels.

As a consequence, the 30-inch panels are all restricted to a Dual Link DVI interface; they offer no onscreen display options, such as contrast, color, or even color temp adjustments, and if your videocard doesn't carry HD digital copy protection (HDCP) over a Dual Link signal (and most don't), you're forced to watch copy-protected high-def content at 1280x800 resolution (half the screens' native res).

Back in May, we predicted the situation would be remedied in time—we just didn't expect it to happen so soon, and certainly not by the likes of Gateway. But perhaps it's precisely because Gateway has fewer resources, and thus a smaller development team and less bureaucracy, that the company was able to see a solution outside the box. That solution is the Silicon Optix HQV Teranex Realta video processing chipset. Capable of performing a trillion operations per second, this video processor has previously been found only in broadcast-industry equipment and high-end home-theater gear, but its pixel-by-pixel algorithmic scaling now serves to make Gateway's XHD3000 the most flexible 30-inch desktop LCD around.

For starters, the XHD3000 features an array of interface options (see spec box), so you can not only connect to the monitor with a variety of different cables but also have multiple devices hooked up to the screen at once. Then you can switch between, say, your gaming console, laptop, DVD player, cable box, and PC (with each source set at a different resolution) using the onscreen display menu—accessible via touch-sensitive buttons on the monitor's bezel—or the included remote control. Picture-in-picture functionality gives you access to two content sources simultaneously.

The scaler also makes it possible for you to adjust the screen's brightness, contrast, and color, regardless of interface. Bundled EZTune software offers similar options, with the aid of step-by-step adjustment and calibration instructions. It also offers some additional PiP preferences, including the option to make a PiP window invisible with a simple mouse rollover.

The XHD3000 is unique in yet another respect: It offers decent built-in audio. We're usually loathe to even mention the presence of a monitor speaker because we don't want to encourage any reliance on tinny, underpowered audio, but the eight transducers that span the XHD3000's front-mounted speaker bar are capable of producing fairly rich sound at high volume. It doesn't deliver the same bass response as a good stand-alone set of speaks, but it's a worthwhile option if you want to save desk space.

Of course, the meat and potatoes of any display is screen performance, and here, too, Gateway's on it. The XHD3000's black looks inky, and a completely dark screen reveals only slight signs of backlight at the corners; grayscale reproduction is strong, showing clear distinction of shades at the extreme light and dark ends, and the picture holds up when viewed off-axis.

The screen is capable of playing HDCP-encumbered content at its intended res and the results are impressive. Gaming is also a pleasure on the screen's wide expanse. A powerful PC will let you play at the screen's native res, but there's no harm in scaling the res down for faster frame rates. Either way, the screen's pixel response keeps apace with the gaming action.

You'd think that with all the extras it offers, the XHD3000 would be more expensive than the competition. But it's not. In fact, it's priced lower than 30-inch models from Samsung, HP, and Apple and is only slightly more expensive than Dell's 30-inch. If you're after maximum screen real estate and ultimate usability, the XHD3000 is well worth the shekels.

—KATHERINE STEVENSON

SPECS

NATIVE RESOLUTION	2560x1600
INTERFACE	Single and Dual Link DVI, HDMI, Component, Composite, S-Video, VGA, USB 2.0 (six ports), audio inputs for all video inputs
HIGH-DEF SUPPORT	1600p, 1080i, 1080p, 720p, 480i, 480p

GATEWAY XHD3000

FULL BAR
Nice, big picture; inputs aplenty; highly versatile.

FUBAR
Big investment; big power brick; gaming can be slow at native res.

9

MAXIMUM PC KICKASS

$1,700, www.gateway.com

24-inch LCDs

A large screen does not a good monitor make

Planar's PX2411W is the perfect monitor for folks who don't like fun.

It's easy to be seduced by the sheer size of a 24-inch LCD screen—any display that big just looks like it means business. And there was a time when large LCD panels were almost exclusively high-performance parts. That's no longer the case. As the 24-inch LCDs reviewed here demonstrate, large screens are just as varied and prone to flaws as their smaller counterparts.

—KATHERINE STEVENSON

WESTINGHOUSE L2410NM

At 24 inches, an LCD can easily serve as an entertainment display, and the L2410NM encourages that thinking: It has a showy but tasteful bezel made of shiny black and clear acrylic, and it sits upon a clear acrylic base. Inputs for HDMI, VGA, Component, S-Video, and Composite let you connect the L2410NM to devices other than a PC, such as a DVD player or game console. The inclusion of HDCP lets you play any of today's copy-protected high-def content on the 1920x1200-resolution screen.

The Westinghouse L2410NM looks most impressive when it's turned off.

But the L2410NM isn't accommodating in all ways. The screen can't be raised or lowered and it doesn't swivel or pivot. And while you can tilt it to and fro, the hinge is so stiff that you must firmly hold down the base to do so. You can adjust the screen's image only by choosing from Text, Picture, or Economy modes for a slight change in backlight and contrast. Not even brightness can be altered independently.

The L2410NM fared well in DisplayMate (**www.displaymate.com**), its only notable flaws being a less-than-rich black and some loss of detail at the far light and dark ends of grayscales. And in our estimation, it's perfectly serviceable for gaming. But the screen lacks vividness, making the picture as mediocre as the rest of the product.

WESTINGHOUSE L2410NM **7**

$600, www.westinghouse.com

PLANAR PX2411W

It's got the same screen size and resolution as Westy's LCD, but Planar's PX2411W is clearly intended strictly for desktop use. Its plain, flat-black aesthetic is very office-appropriate, inputs are limited to DVI and VGA, and HDCP is not available through the digital interface, so you'll have to watch protected content over VGA.

You can't even play games on the PX2411W. Well you can, but you might be put off by the periodic hitch in the picture when the screen is displaying motion at a high frame rate. When we saw this issue in an HP LCD (September 2006), it was attributed to the panel's limited v-sync variance. Whatever the cause, it's a flaw we can't ignore. And the same goes for the ghosting we observed in areas of high contrast.

So it's of little use to us that the PX2411W offers some convenient features, such as a telescoping neck for height adjustment and a variety of OSD options. Or that it performed passably in DisplayMate and functions acceptably for web surfing, movie viewing, and other typical screen tasks. You're better off with one of the other two LCDs, which happen to cost less.

PLANAR PX2411W **4**

$630, www.planar.com

HP W2408

It might surprise you that the w2408 is the least expensive of the three LCDs here, because it seems to offer the most. It has a chic, shiny bezel like the Westinghouse—and a chic, shiny screen to match. The glossy surface can be real image booster, making colors appear more vibrant than they do on coated panels. But in a well-lit room the screen is like a mirror, reflecting you and everything else around, so consider your environment before buying.

The w2408 also offers ergonomic adjustments, including height and pivot, plenty of user controls via the OSD, and software that instructs the panel to assess environmental lighting and adjust the picture accordingly. It has DVI, VGA, and four USB ports. And it's equipped with HDCP support.

The w2408 features HP's EasyClip bezel, which lets you attach accessories like a webcam or a, um, miniature flower vase.

But despite all the features in its favor, the w2408's performance failed to win us over. The glossy 1920x1200 screen really enhances movies and games, and we didn't notice visual anomalies in either circumstance, but a couple issues reared their heads in DisplayMate. Banding appeared throughout the utility's grayscale test screens, and we detected some color-tracking discrepancies. These issues weren't apparent in most real-world content, but they did show themselves in high-res illustrations. Enough so, at least, to temper our recommendation.

HP W2408 **8**

$570, www.hp.com

LG Super Multi Blue GGW-H20LI

The argument for adopting next-gen optical is getting slightly more persuasive

Bundled with Cyberlink's PowerDVD, the GGW-H20LI lets you play both Blu-ray and HD DVD movies.

It's no surprise that high-def optical drives are getting less expensive while their specs improve—that's the trajectory of all emergent technologies—but we are still taken aback by the dramatic strides LG's GGW-H20LI represents. Just a few months ago, in our September issue, we reviewed this drive's predecessor, the GGW-H10NI, and not only is its follow-up better in every respect, it's half the price!

Granted, at $1,200 the earlier model was priced out of the stratosphere—consumers paid a premium for its unique ability to read both HD DVD and Blu-ray media (while writing to just the latter). The GGW-H20LI also offers this convenience. Plus, it offers a welcome speed increase for Blu-ray burns.

BENCHMARKS

	LG GGW-H20LI	LG GGW-H10NI
DVD WRITE SPEED AVERAGE	**12.09x**	6.67x
DVD READ SPEED AVERAGE	**9.24x**	7.61x
ACCESS TIME (RANDOM/FULL)	**99ms/192ms**	190ms/374ms
CPU UTILIZATION (8X)	**23%**	30%
TIME TO BURN 22.5GB TO BD-R (MIN:SEC)	**21:23**	27:27
TIME TO BURN 22.5GB TO BD-RE (MIN:SEC)	**39:38**	45:11

Best scores are bolded. All tests were conducted using the latest version of Nero CD-DVD Speed and Verbatim media. Our test bed is a Windows XP SP2 machine, using a dual-core 2.6GHz Athlon 64 FX-60, 2GB of Corsair DDR400 RAM on an Asus A8N-SLI motherboard, an ATI X1950 Pro videocard, a Western Digital 4000KD hard drive, and a PC Power and Cooling Turbo Cool 850 PSU.

Rated at 6x for BD-R media, the GGW-H20LI took 21:23 (min:sec) to write 22.5GB to a single-layer disc in our tests. That's a 6-minute savings over this drive's 4x predecessor. (Frankly, we were expecting to see more savings, since the 4x drive nearly halved the times of its 2x competitors, but we'll take what we can get.) We saved just about 6 minutes when writing to rewriteable media as well, with the GGW-H20LI filling a single-layer BD-RE disc in 39:38.

But really, given the high cost of Blu-ray media ($12 to $15 per single-layer disc), not to mention the still-lengthy burn times, this drive's DVD performance matters as much or more to most users. Rated at 16x, the GGW-H20LI took 5:40 (min:sec) to fill a single-layer DVD+R, while its predecessor took more than 10 minutes. Even dedicated DVD burners aren't much faster—the Samsung SH-S203B, our pick for "Best of the Best" (see page 46)—took 5 minutes to complete this task.

It's reign might not last long, but for now the GGW-H20LI is the fastest, most versatile high-def optical burner available and made all the more attractive by its handsome façade and SATA interface.

—KATHERINE STEVENSON

LG SUPER MULTI BLUE **9**

$500, www.lge.com

MAXIMUM PC KICKASS

SilverStone DS351

Bah humbug to the averageness of this enclosure

Temperature readings on the front of the DS351 are a welcome addition; however, the device doesn't ship with any fans.

We have 300 words to tell you about the wonders of SilverStone's DS351 external hard drive enclosure, but we need just four syllables: me-di-o-cre. It's not that the enclosure is overwhelmingly slow, broken, or impossible to manage, but the device dips its toe enough into each of each these categories to make for a less than stellar experience.

First, there's the installation. The DS351 comes with a drive bay of sorts that you have to separate and remove from the unit before you can fill it with storage devices. Up to four drives go in the bay; the fifth drive attaches directly to the enclosure. Removing the bay requires the use of a long-necked screwdriver. This doesn't sound like a big deal, but once you've run through your house and realized that all you have are smaller, stouter screwdrivers, you're hosed. Seriously, SilverStone—there are better ways to hold hard drives.

Firing up a RAID array is easy once the drives are in place. The included software is straightforward, and you don't even have to muck around in Windows's drive-management screens or initialize any drives. You pick your RAID, apply the change, and that's it—done and done.

BENCHMARKS

	DS351 (SINGLE DRIVE)	DS351 (RAID 0)	DS351 (RAID 1)
BURST SPEED (MB/S)	**123.6**	115.2	67.6
RANDOM ACCESS (MS)	8.4	**8.2**	**8.2**
CPU USAGE	**0%**	3%	1%
AVERAGE READ (MB/S)	75.5	**101.3**	64.1

Best scores are bolded. HD Tach benchmarks were run using one or two 150GB Western Digital Raptor drives.

The performance of said RAID, however, leaves something to be desired. When we connected a single Western Digital Raptor drive to the DS351, we found that the enclosure's speeds matched the performance of the same Raptor drive connected directly to the motherboard via SATA. Two Raptor drives in a RAID 0 array on the DS351 ended up being faster than a single drive but didn't offer the absurd jumps in speeds we're used to seeing in these comparisons—perfectly evidenced in the DS351's poor RAID 1 performance.

Like a baloney sandwich, the DS351 will get you by, but it won't be all that tasty—we've devoured far better enclosures.

—DAVID MURPHY

SILVERSTONE DS351 **6**

$500, www.silverstonetek.com

Kingwin Revolution RVT-9225

What it gains in cooling, it loses during installation

Borrowing a page from car enthusiasts, the RVT-9225 comes with a spoiler that you manually insert into the posterior of the device.

It's hard to find much innovation in the exciting world of air cooling. At some point, cooling potential is defined by a simple equation of heat pipes, fan speeds, and block materials—increase the efficiency of any of the above, and you'll see lower temperatures.

At least, that's the *theory*. Kingwin's Revolution RVT-9225 cooler isn't exactly the Eva Peron of CPU devices, but it does a respectable job of bringing our test bed CPU back from the inferno. If only this device were easy to install. Its locking mechanism is better than some we've seen, but only if we're comparing it to the very bottom of the barrel. You insert the AMD retention system into a notched groove on the flip side of the CPU block, which is awesome for guidance, but it means the cooler can face only one of two directions, limiting your ability to modify your case's overall airflow.

The challenging locking clasp on the RVT-9225 provides our biggest complaint. When applying pressure to the clip to secure the cooler to the CPU, you'll think you're breaking the device—we sure did—as it takes a Herculean effort to mount this cooler.

We were happy with the performance of this mildly loud device. It doesn't top the ear-splitting cooling of our champ, Zalman's CNPS9700, but it certainly comes close. The three-heat-pipe design dropped our CPU by six and 12 degrees on our idle and burn-in tests, respectively. While it's not the kind of bone-chilling performance we expected from a cooler that runs its heat pipes directly alongside the base of the CPU block, it's nice to see that the device can hold its own against the best—and loudest—we've seen.

The RVT-9225 has proven itself as one of the better devices in the midrange cooler market, especially considering it's cheaper than dirt. Just try not to break your fingers during the installation.

—DAVID MURPHY

BENCHMARKS

	STOCK COOLER	KINGWIN RVT-9225	ZALMAN CNPS9700
IDLE (C)	31	25	**22.5**
100% LOAD (C)	54.5	42.5	**38**

Idle temperatures were measured after 30 minutes of inactivity, and full-load temps were measured after running CPU Burn-in for one hour.

KINGWIN REVOLUTION **7**

$30, www.kingwin.com

Zalman Reserator XT

Cooling with a cost—be prepared to spend some time with this device

The Reserator XT's front panel does an amazing job of telling you just how fast its fan is spinning.

Zalman is no stranger to gigantic external liquid-cooling devices. We've become so accustomed to seeing its huge, tower-like Reserator coolers that we nearly choked when the 15-pound Reserator XT arrived in our Lab. For starters, it's not a large, awkward-to-carry cylindrical column. The rectangular apparatus is comparably compact and sleek, more akin to a subwoofer than a home-theater speaker.

While the rectangular device works wonders as a doorstop—even better once you dump 1.25 liters of fluid into its aluminum bay—it serves far better as an external cooler for your CPU, provided you don't mind a little bit of a setup, that is.

We expect a bit of a construction process when we cross the line from snap-and-clip air cooling to where-are-the-napkins liquid kits. The Reserator XT tested our patience by riding the delicate balance between annoying and infuriating. Instead of priming the machine by pouring liquid into the reservoir, you must jostle the whole device back and forth (while turning it on and off, *while* a beeping alarm is blaring) just to get fluid into the special "degassing" tube. Attaching the water block to the Reserator XT forces you to pry the special no-spill nozzles off of the ends the degassing tube (not fun) and reattach them to the virginal 3/8-inch tubing. Apparently, the concept of giving you two extra nozzles didn't cross Zalman's mind.

As for the cooling, the chart says it all. This thing poured a pitcher of rock-out all over our air coolers, beat all the lame, preconstructed water-cooling units we've encountered, and even rivaled our favorite peltier coolers in terms of degrees cooled. Our only hesitation comes from the lack of a difference in performance when the fan is running silently versus cranked. That's awesome for those who like quiet low temperatures, but it would have been nice to see increased performance when the device is at full power.

—DAVID MURPHY

BENCHMARKS

	STOCK COOLER	ZALMAN RESERATOR XT (LOW)	ZALMAN RESERATOR XT (HIGH)	ZALMAN CNPS9700
IDLE (C)	32	20	**19**	22.5
100% LOAD (C)	54	35.5	**33**	37.5

Idle temperatures were measured after 30 minutes of inactivity, and full-load temps were measured after running CPU Burn-in for one hour.

ZALMAN RESERATOR XT **8**

$450, www.zalmanusa.com

Archos 605 WiFi

Too much of a good thing

The Archos 604 has been one of our favorite digital media players since its introduction late last year. Our opinion of the new Archos 605 WiFi—which adds a high-resolution touch screen and wireless networking capabilities—isn't as lofty.

Although the 605 offers a screen with the same dimensions as the 604 (4.3 inches, 16:9 aspect ratio), we fully expected its enhanced resolution (800x480 pixels compared to 480x272) to knock our socks off. After repeated viewings of slightly washed out digital photos and videos, our metatarsals remain firmly ensconced in argyle.

The touch screen works great—it's a much easier means of navigating the player's menus than the column of buttons on the right side of the device—so we can overlook the need to use a stylus. But if the touch screen is to blame for the screen's vaguely hazy look, the trade-off isn't worth it.

The same goes for the 605's wireless-networking capabilities, which we assume are responsible for causing the new player to burn through a battery charge even faster than its off-line predecessor. We got less than four hours of play time while watching videos and making moderate use of the wireless network feature (despite the fact that the player drops its connection after just a few minutes of inactivity in order to go into battery-conservation mode).

Actually, the wireless feature isn't terribly useful unless you also purchase a special version of Opera, which adds a full 10 percent to the purchase price. Right. When's the last time you contemplated *buying* a web browser? That and the connectivity issue aside, Opera proved to be a solid fit for the Archos player. We had a good experience visiting many of our favorite sites without having to rely on web pages that were optimized for use with portable devices.

Archos managed to add features to one of our favorite media players while cutting its price tag. So why aren't we smiling?

We're also not impressed with the 605's stingy storage capacity (30GB, just like the 604) and Archos's insistence on using a proprietary USB cable (they tell us this is a necessary evil, but that doesn't make it any less of a pain in the caboose).

—MICHAEL BROWN

ARCHOS 605 WIFI **5**

$300, www.archos.com

B&W Zeppelin iPod Speaker Dock

The best dirigible we've ever heard

For many, the initials B&W will conjure images of Ansel Adams photographs and Hollywood classics; the thoughts of audiophiles, however, will turn fondly to the legendary speakers of Bowers & Wilkins. The idea of B&W turning *its* thoughts to the iPod will blanch the cheeks of many a blue blood, but we're damn happy the Zeppelin has landed.

We've been expecting someone to knock Klipsch's iGroove HG off its pedestal, and the Zeppelin hurls it to the ground, stands over it and urinates, and then lights it on fire. Then again, the Zeppelin's price tag is treble that of the iGroove HG's, so its introduction doesn't really diminish our opinion of Klipsch's product.

The iPod docks to a podium that emerges from the bottom of the Zeppelin to hover over its middle. A spring mechanism automatically adjusts the dock so that any model iPod will rest securely against a rubber stop on the back. Unobtrusive buttons for power and volume are embedded in a band behind and just above the dock, but most people will rely on the wireless remote. Composite and S-Video outputs enable you to watch videos on your TV.

Most enclosures in this class are made from simple injection-molded plastic, but the Zeppelin's shell is fabricated from highly polished stainless steel lined with a thick layer of sound-damping polymer. A pair of 1-inch aluminum-dome tweeters are mounted at each end, along with two 3.5-inch glass-fiber midrange drivers. A 5-inch woofer is mounted in the middle.

Price/performance ratios be damned! The $600 Zeppelin delivers unbelievably great audio performance.

An integrated amp delivers 50 watts to the bass speaker and 25 watts to each of the other speakers. Our experience backs B&W's claim that an onboard digital signal processor automatically adjusts frequency balances in response to volume levels. The Zeppelin delivered more than enough power to fill the 16x12-foot media room we're now using to test audio products: We experienced chest-thumping bass and crisp highs at all levels while listening to Ben Harper's "Excuse Me Mr." (from *Fight for Your Mind*). If you can swing the fare, the Zeppelin delivers a high-flying audio experience.

—MICHAEL BROWN

B&W IPOD SPEAKER DOCK **9**

$600, www.bowers-wilkins.com

MAXIMUM PC KICKASS

Creative Aurvana X-Fi Headphones

Sound Blaster maker delivers the sound of silence

We've never liked headphones that use active noise cancellation because they simply mask environmental noise by generating background hiss. But Creative's Aurvana X-Fi headphones are almost good enough to win us over.

Donning the headphones and activating their noise-cancellation circuit instantly silenced the background cacophony created by our building's HVAC system and myriad nearby computers—and we could barely detect the circuitry used to accomplish the feat.

That's impressive, but Creative has also taken two features from its X-Fi soundcards and embedded them in these phones. We're big fans of Creative's X-Fi Crystalizer because it adds a natural and pleasant sonic presence to both compressed music (e.g., MP3s and WMAs) and songs played straight from CD. We're not so impressed, however, with Creative's X-Fi CMSS-3D, an algorithm that taps the onboard DSP to widen the stereo sound field.

Audio purists, of course, will cringe at the thought of using any of these features because this processing alters what the artist has wrought. And as much as we like the noise-canceling feature's ability to isolate us from the outside world, we did turn it off while listening to music because it adds a harsh edge to midrange frequencies. We found this phenomenon particularly noticeable while listening to the guitar and Linda Thompson's plaintive vocals on "Walking on a Wire" (from her collaboration with former husband Richard Thompson, *Shoot out the Lights*).

Creative's Aurvana X-Fi noise-canceling headphones are terrific travel companions.

These headphones are clearly not designed for mission-critical applications such as monitoring mix downs. They also consume batteries at an alarming rate: Having neglected to turn them off before leaving for the day, we came in the next morning to find their two AAA batteries completely drained (they behave like normal headphones without power, so the lack of batteries doesn't render them useless).

As much as we like Creative's X-Fi Crystalizer technology, as great as the Aurvana X-Fi headphone's sound, and as nonintrusive as their noise-cancellation circuitry is, we still prefer the passive noise-blocking technology offered by in-ear phones such as Shure's SE530.

—MICHAEL BROWN

CREATIVE AURVANA X-FI **8**

$300, www.creative.com

KRK VXT 4 Bi-Amplified Studio Monitor

These tiny tots delivery mighty sound

The primary benefit of near-field studio monitors like KRK's VXT 4s is that they don't interact with the room. And that's exactly what you need if you're mixing down tracks in a sonically challenged environment such as a home recording studio, which probably doubles as your bedroom, living room, or garage.

But most desktop speakers are designed for near-field listening, so what makes the VXT 4s worthy of their $300 (each) street price? They're bi-amplified, for one thing, meaning the woofers and tweeters are powered by their own amplifiers, with 15 watts dedicated to the production of high frequencies and 30 watts to the lows. And unlike most other powered speaker systems, in which one amp provides the power for the entire system, each VXT 4 has it own amp inside its cabinet. This gives you the flexibility of starting out with a stereo mix station today and expanding it into a surround-sound rig down the road.

The VXT 4s are the smallest speakers in the VXT line and draw their name from their 4-inch Kevlar woofers. Kevlar's strength and light weight—the same material is used to manufacture bullet-proof vests—helps the cones resist movement after they've been initially stimulated by the amplifier. These are augmented by 1-inch dome tweeters woven from pure silk.

In an effort to reduce cabinet resonance, KRK fabricates its cabinets out of ABS structural foam, instead of the more common medium-density fiberboard (MDF). The base of each cabinet is padded to further isolate it from whatever surface it might be resting on, and there are threaded mounts on the bottom in case you'd like to mount the speakers on a wall or a tripod.

KRK has packed a ton of pro features into the tiny VXT 4 studio monitors.

Listening to Stevie Ray Vaughn's "Say What!" (from *Soul to Soul*), we dug how clean the music sounded, but we found ourselves wishing for just a bit more bass. The VXT 4s produce an amazingly tight bottom considering their tiny woofers, but anyone using them for final mixes will want to be careful not to overdo it.

—MICHAEL BROWN

KRK VXT STUDIO MONITORS **8**

$300, www.krksys.com

Sony Acid Music Studio

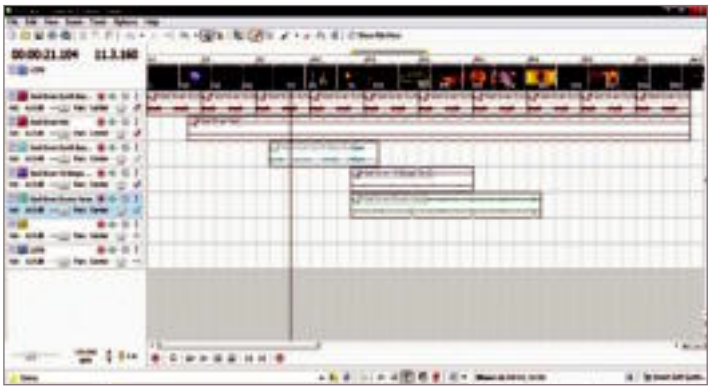
As far as music software goes, it's a trip!

Our dreams of moonlighting as DJs will likely never come to pass, but we can at least sharpen our remixing skills with Sony's Acid Music Studio. Acid has been around for years, but this newb-friendly version of the $375 Acid Pro has delights that are sure to please any aspiring club-thumper.

Whereas programs like Ableton come with built-in synthesizers that allow you to create your own musical loops, Acid focuses on organizing preconstructed loops into songs. Ingenious users can splice these loops themselves using the program's built-in cutting board, but typical mixmasters will likely get their sound loops through the program itself—Acid Music Studio comes with a number of preconstructed, downloadable tracks.

Acid Music Studio, though simple to use, takes a lifetime to master; fortunately, your adventures are helped along by a tutorial system that literally highlights everything you need to do. Our only complaint is that the tutorials aren't comprehensive enough—a bit more hand-holding through the entire song-creation process would be ideal, as opposed to splitting the help into individual chunks.

Acid's capacity for manipulating sound clips has always been the program's main selling point—it's as easy as dropping in a loop and dragging it for however long you want the sequence to play. The program works on a grid/measure system, although you do have the option of unsnapping clips to create some wicked off-beat grooves. Transforming the clips with audio effects is a two-click process, but again, we find Acid's options somewhat lacking. You get



Acid Music Studio allows you to string video alongside your musical creation, but the program severely limits your video-editing options.

all the standards—including modifications for chorus, reverb, and delay—but the absence of unique plugins dilutes Acid's strength. Although each plugin does come with preset options, that isn't much of a consolation.

Acid Music Studio is a good value, even though its features fall short of what's available with more expensive software. This makes it a sound investment for those who want to get their musical feet wet; professionals, on the other hand, will undoubtedly want more.

—DAVID MURPHY

SONY ACID MUSIC STUDIO **8**

$60, www.sony.com

Ulead VideoStudio 11 Plus

The only game in town for AVCHD editing

Just bought a snazzy new camera that records to AVCHD but don't have the software to edit it? No problem. Ulead's VideoStudio 11 Plus pitches itself as the only app capable of fully editing video captured using Sony's and Panasonic's new H.264-based codec, which works with mini-DVDs, hard drives, and flash memory inside cameras. (Nero was technically first, but its editor is pretty threadbare.)

That's not the only new feature in Studio 11 Plus, though. The app now supports burning to HD DVD, but not Blu-ray. We find this limitation odd because we still haven't seen an HD DVD burner on the consumer market while Blu-ray burners are approaching the $500 mark. In any event, Ulead says it'll offer Blu-ray support "soon" and cites standards-ratification problems as the holdup.

Unfortunately, most of our complaints concerning Studio 10 remain true for Studio 11: playback that halts when you change the scale of the timeline, keyboard commands that are difficult to find, and various instances of slow performance. It's also clunky. If you insert video into your project, the application doesn't automatically shift audio or other elements to make space for it. That's just plain dumb.

While we did successfully capture and edit HDV-resolution video from a Canon HV10, performance was subpar despite the ability to use a "smartproxy" method that uses a lower-resolution proxy. And as we mentioned, performance hasn't improved since VideoStudio 10. Encoding, playback, and responsiveness were sluggish on our Athlon 64 FX-60 box with 2GB of RAM. Premiere Elements 3.0 and CyberLink PowerDirector 6—both capable of editing HDV content—felt far more responsive.

VideoStudio does some things nicely, though. White balance and color correction are fairly intuitive. We especially like the white-balance icons, which most people will find familiar from their digital still cameras, and a couple of new filters

Setting white balance is a snap using an icon system borrowed from Ulead's digital-image editor.

helped clean up noise on video recorded from TV and the Internet. The app imported video from unencrypted commercial DVDs without a problem as well.

Sadly, while there's plenty that's new here, there are plenty of problems, too. Right now, VideoStudio's main saving grace is AVCHD capability, but there are better choices elsewhere, such as Pinnacle's new Studio 11 (which also now does AVCHD) or even Premiere Elements.

—GORDON MAH UNG

VIDEOSTUDIO 11 PLUS **6**

$130, www.ulead.com

The Orange Box

With tons of Half-Life goodness, Team Fortress 2, and Portal, this is the best deal in gaming history

Team Fortress 2 is our favorite part of The Orange Box, and we dig it for more than its stunning character designs!

Finishing The Orange Box left us in a state of shock. It wasn't Half-Life 2: Episode 2's requisite cliffhanger ending that floored us; rather, it was the realization that Episode 2 is the *low point* of the entire Orange Box package. Portal and Team Fortress 2 completely eclipse what Valve bills as the "centerpiece" of the bundle.

Don't get us wrong, Episode 2 is not a bad game. It's more of the same Half-Life 2 goodness, chock-full of physics puzzles and zombie killing; Valve even doles out a few more tidbits of the story of humanity's battle against the Combine.

That said, Episode 2's biggest failing is that it's more of the same: the same types of puzzles, the same enemies, and the same environments. The game remains extremely linear, with a well-defined path littered with choke points and the occasional set-piece battle. Sadly, however, the self-guided storytelling that was prevalent in the earlier games is lessened—the noncombat environments don't have as many items that trigger monologues from the characters.

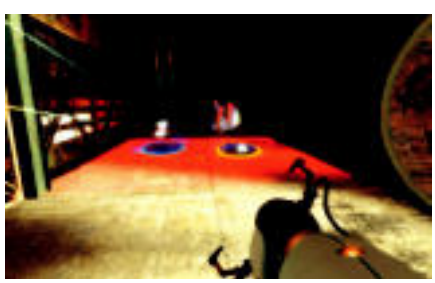
We hope you like fighting Striders; they're the official baddie of Episode 2.

Portal lies at the opposite end of the innovation spectrum. This game delighted us with its innovative gameplay and twisted sense of humor. The concept is simple: You have a gun that lets you rip holes in the space-time continuum, which you can then move materials (or yourself) through. More puzzle game than first-person shooter, Portal's genius lies in the way it introduces new concepts and gameplay mechanics to the player, then immediately forces you to utilize those mechanics in combination with everything you've learned before. Although it's short, Portal delivers nonstop fun from the opening sequence to the end credits. It's quite simply the most entertaining four hours we've spent this year.

And then there's Team Fortress 2. The first thing you'll notice about TF2 is its unique *Incredibles*-esque art style and character design. The second thing you'll notice is that it *is* Team Fortress. Not a reimagining. Not a modernized class-based shooter. It's Team Fortress Classic, perfectly balanced, with all the rough edges smoothed off, and it is, without a doubt, the best multiplayer shooter we've played this year (sorry, Quake Wars).

The game retains all nine original classes from Team Fortress, each honed to fulfill a core role while items that blurred lines between different classes have been removed. This ensures that no class encroaches on another class's role. Having such a wide variety of classes in the game ensures that no two matches play the same. You must constantly tweak your team composition in order to succeed—there's no perfect combination of classes.

What really surprised us about TF2 is that Valve included only six maps. While we were initially torqued by this paltry number, the collection is rich and hearty. Because the community for this type of game usually ends up playing on only a handful of maps—we call this the Karkand Effect—Valve concentrated on building six arenas that truly kick ass. Remakes of classic maps like 2Fort and Dustbowl are welcome, but we love the new Hydro map, which reconfigures itself from one round to the next to provide near-infinite replayability.



Don't let the small screenshot fool you—Portal is one of the best single-player games of the year.

With Team Fortress 2, Portal, Episode 1, Episode 2, and Half-Life 2, this is the can't-miss gaming package of the year.

—WILL SMITH

THE ORANGE BOX

BARNEY
Amazing value; Portal is top-notch; TF2 is riotous multiplayer fun.

ADRIAN SHEPHARD
Episode 2 lacks innovation; TF2 needs more The Hunted.

9

MAXIMUM PC KICKASS

$50, www.half-life2.com, ESRB: M

Enemy Territory: Quake Wars

That tremor you feel is the revival of a franchise

When we think of Quake games, we think of fast-paced deathmatches in their purest no-nonsense form. In Enemy Territory: Quake Wars, the latest iteration of the shooter franchise, that visceral run-and-gun experience still makes up the foundation of gameplay, but the integration of deep teamplay tactics and mission objectives makes this a whole new multiplayer animal. The meld of cooperative squadplay and frenzied firefighting makes for compelling matches, but both deathmatch and tactical purists may find themselves in slightly unfamiliar territory.

We fought for possession of Earth across 12 battlegrounds as both GDF and Strogg forces, each round structured in an assault and defend format. Up to 32 players fill the battlefield, contributing to the fight in one of five roles: Nothing special here—you choose between the typical assault, medic, engineer, field ops, and covert ops classes. What's unique is the asymmetry that Quake Wars applies to the two sides. While the GDF rely on conventional bullets and ammo, the Strogg use an energy source called Stroyent that doubles as ammo and health. Strogg can also use the bodies of dead GDF soldiers as remote spawn points. With the addition of other weapon and special-ability differences, we had to adapt our tactics to accommodate the advantages of each side.

Helpful tooltips give each player sub-missions and goals unique to their classes, leading Aggressors to plant explosive charges at vault doors and Infiltrators to hack computer systems. Quake Wars's map objectives are some of the most diverse we've seen in a multiplayer game. On the Slipgate map, the GDF team has to commandeer a forward control point, hack the eponymous gateway, escort a Mobile Command Post through the wormhole, and finally demolish a Strogg Nexus tower.

The fast-paced close-quarters combat is reminiscent of classic Quake deathmatch.

Awesome objectives aside, we weren't impressed with the graphics of the "Megatextured" game, which suffered from overused browns and last-gen lighting. But once we got past the superficial deficiencies, we were in for a fresh multiplayer experience worthy of the Quake name.

—NORMAN CHAN

QUAKE WARS **8**

$50, www.quakewars.com, ESRB: T

World in Conflict

Proof that mutually assured destruction is not a viable nuclear deterrent

Nothing flexes our imagination like alternate history scenarios, and World in Conflict delivers one that has us on the edge of our seat. It's the late 1980s, and the Cold War is far from over. The commies have already made a push to invade Western Europe, and in a desperate move, have decided to mount a sneak attack on American shores. It's your mission to contain the Soviet invasion and retake Seattle before the invaders paint the country red.

WiC isn't just the prettiest strategy game we've ever played—the effects are stunning—it's also one of the most tactical. In each mission, you're charged with capturing a series of control points with a limited number of units. The game eschews base building and unit construction by giving you a set number of points to call in vehicle and infantry airdrops. Points are reclaimed after your troops perish, so the strategy becomes how you allocate the various types of tanks to capture and hold the front lines. This Battlefield-esque reinforcement scheme ensures there's never a long break in the action, but also gave us enough time to plan our next assaults.

The suburbs of Washington state and the bleak wilderness of Eastern Europe are just a few of the amazingly detailed battlegrounds ready to be demolished in the game. In-game cut scenes help flesh out the narrative by giving glimpses into the lives of the soldiers fighting under your command. The war at home feels very real; its impact resonates even more when nukes are detonated on American soil.

Zoomed in, World in Conflict looks better than some first-person shooters.

Taking the fight online yields another fresh RTS experience. Players team up to take on armor, air, support, and infantry roles, each with special units that uniquely contribute to an overall match. We dug using helicopters to rain down guided missiles of justice, but found the support role not as useful as the other offensive classes. Online niggles aside, World in Conflict is one of the most accessible and action-packed strategy games we've ever played.

—NORMAN CHAN

WORLD IN CONFLICT **9**

$50, www.worldinconflict.com, ESRB: T

Win Rig of the Month AND WIN BIG!

IF YOUR MODDED PC IS CHOSEN AS A RIG OF THE MONTH, IT WILL:

1. Be featured before all the world in *Maximum PC*
2. Win you a $500 gift certificate for eWiz.com

SO WHAT'S STOPPING YOU?

TO ENTER: Your submission packet must contain your name, street address, and daytime phone number; no fewer than three high-res JPEGs (minimum size 1024x768) of your modified PC; and a 300-word description of what your PC represents and how it was modified. Emailed submissions should be sent to **rig@maximumpc.com.** Snail mail submissions should be sent to Rig of the Month, c/o Maximum PC, 4000 Shoreline Court, Suite 400, South San Francisco, CA 94080.

The judges will be *Maximum PC* editors, and they will base their decision on the following criteria: creativity and craftsmanship.

ONE ENTRY PER HOUSEHOLD. Your contest entry will be valid until (1) six months after its submission or (2) January 2, 2008, whichever date is earlier. Each month a winner will be chosen from the existing pool of valid entries, and featured in the Rig of the Month department of the magazine. The final winner in this contest will be announced in the March 2008 issue. Each of the judging criteria (creativity and craftsmanship) will be weighed equally at 50 percent. By entering this contest you agree that Future US, Inc. may use your name and your mod's likeness for promotional purposes without further payment. All prizes will be awarded and no minimum number of entries is required. Prizes won by minors will be awarded to their parents or legal guardians. Future US, Inc. is not responsible for damages or expenses that the winners might incur as a result of the Contest or the receipt of a prize, and winners are responsible for income taxes based on the value of the prize received. A list of winners may also be obtained by sending a stamped, self-addressed envelope to Future US, Inc. c/o Maximum PC Rig of the Month, 4000 Shoreline Ct, Suite 400, South San Francisco, CA 94080. This contest is limited to residents of the United States. No purchase necessary; void in Arizona, Maryland, Vermont, Puerto Rico, and where prohibited by law.

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We tackle tough reader questions on...

✓Windows XP ✓802.11n ✓Slow Machines ✓Pixel Shader 3.0 ✓Dream Machine

I WANT MY... I WANT MY WIN XP

Microsoft claims that as of January 2008, Windows XP will no longer be sold and Vista will be the only version of Windows available. Can such horrible news be true? Vista has loads of problems, ranging from shoddy SLI support to 3D sound that still doesn't work properly—and it's slow! Is the PC supposed to run other programs or just the OS?

—Yonasan Resnick

EDITOR IN CHIEF WILL SMITH RESPONDS: Luckily for consumers, Microsoft has given Windows XP a stay of execution, at least for another six months. Microsoft has pledged to continue selling Windows XP until June 30.

WE GOT OURSELVES A CONVOY!

I read the article "Clear Skies for 802.11n" in the November 2007 issue, but I don't fully understand the concept of channel bonding. I know that B/G routers run at 2.4GHz, but the article discusses bonding channels at 20MHz and 40MHz. Do you mean N routers run at 2.4GHz but will bond 20MHz or 40MHz of bandwidth? I know I don't want my router to run on the 20MHz band because that's where ham and citizen-band radios operate.

—Ron D.

EXECUTIVE EDITOR MICHAEL BROWN RESPONDS: Breaker, breaker; you needn't worry about CB or ham, good buddy. The 802.11n routers we tested all operate within the 2.4GHz frequency band. There are 11 channels within that band, and each one is 20MHz wide—that doesn't mean they operate in the 20MHz spectrum. Channel 1 ranges from 2.412GHz to 2.432GHz; channel 2 ranges from 2.417GHz to 2.437GHz; channel 3 ranges from 2.422GHz to 2.442GHz; and so on. Channel bonding combines two of those channels to create one that's 40MHz wide, but there are only three channels (1, 6, and 11) within the 2.4GHz spectrum that don't overlap (channel 6, for example, starts at 2.437GHz, which separates it from the high end of channel 1 by five megahertz).

Channel bonding is further complicated by the 802.11n standard's "good neighbor" policy. Operating a router in channel-bonding mode can impair the performance of other wireless routers operating nearby, so the IEEE dictates that channel bonding be automatically disabled if the router detects other routers operating within its range.

FASTER THAN THE SPEED OF SOUND

I work in the US Air Force as an egress mechanic on fighter and bomber aircraft. As part of our job we have to use an automated computer system to track our work and various Office programs to do other work. Unfortunately, our computers haven't been upgraded in years. They all run Windows XP and have slow RAM, old Pentium 4s, and agonizingly slow drives. We've cleaned out temporary files, erased old emails, and done everything else we can think of, but when doing simple tasks the computers still crawl like turtles in Jell-O.

The military has strict rules and regs on what we can and cannot do to our computers and prohibits us from installing anything without express permission from our IT guys. Is there anything more we can do without messing up our computers/network?

—SrA Brandon Taronji

SENIOR EDITOR GORDON MAH UNG RESPONDS: For what you're doing, even an old, drag-ass P4 should be fine—if the system is spec'd

An Inconvenient Truth

I loved the article on the Dream Machine 2007; however, I noticed the Dream Machine did not include a physics accelerator. Did you run out of PCI slots or are physics cards just not worth it considering you're running that mighty dual-videocard rig? If you didn't have enough PCI slots, couldn't you have left out the soundcard? Is sound that much more important than physics?

—Robert

EXECUTIVE EDITOR MICHAEL BROWN RESPONDS: We have a great deal of respect for what Ageia has created with its PhysX physics accelerator, but the fact is that game developers have just not embraced the product. If Half-Life 2, Quake Wars, World in Conflict, or any other A-list game used the card in such a way as to deliver an awesome experience that was only possible with the Ageia card, we'd recommend it in a heartbeat. But we'll likely see advanced physics that require eight-core CPUs before we'll see PhysX become mainstream.

CUTCOPYPASTE

In the Holiday 2007 issue, on page 76, we inadvertently assigned the neutron, a subatomic particle, a positive charge. In actuality, it holds no charge.

On page 42 of the Holiday 2007 issue, we listed the speed of USB 3.0 as 5Mb/s. In fact, it's 5Gb/s.

with enough RAM. I find that IT departments often under-spec RAM in their machines. So, assuming that your rigs are free and clear of performance-killing malware, I suggest that you beg, borrow, or steal memory to add to the PC—as long as you won't end up in the stockade. My second suggestion is that you have the IT guys reimage the machine. As time goes on, Windows XP "rots" and gets slower. And if you haven't done a defrag, you should.

POWER USERS NEED CAMERAS TOO

You probably caught a bunch of crap for including HD camcorder reviews (Holiday 2007) in the magazine. I just want to say that I enjoy reviews like this. I've been considering purchasing a Panasonic HDC-SD1 (or HDC-SD5), and I'm tired of reading reviews written by people who aren't hardcore PC users. Your perspective on reviews like these is very different from that of other magazines/websites, and it is greatly appreciated.

—Jeremy Powlus

MY ANTIQUATED GPU WON'T RUN YOUR HOT NEW GAME

Why didn't you catch the downside of Medal of Honor: Airborne? If you download the demo and don't have a videocard that supports Model 3.0 shaders, you are out of luck. I'm running ATI's Radeon 9800 PRO, which handles all my gaming needs nicely, but it won't play MOHA. Maybe you can put a bug in someone's ear to offer a patch. Seems even Pacific Assault gives you the option to run with Shader Model 1.0 or 2.0.

—James G. McKinnis

EXECUTIVE EDITOR MICHAEL BROWN RESPONDS: Get with the program, soldier! Shader Model 3.0 has been around since 2004. It's been supported in Nvidia hardware since the GeForce 6 series and in ATI GPUs since the Radeon X1000 series. Seriously, we'd much rather see developers spend their time and money wowing us with awesome graphics than struggling with spaghetti code in order to support aging hardware. BioShock and Quake Wars also require Shader Model 3.0 hardware, but we expect that list to get much longer in 2008. We can't say the same for Shader Model 4.0, since it requires Vista—and Vista currently sucks as a gaming platform.

DREAM MACHINE? MORE LIKE TIGHT-SQUEEZE MACHINE!

I'd like to know how you fit all the cooling parts into Dream Machine '07. The project inspired me to build my new machine with water cooling, and I used many of the same parts you used. However, I couldn't fit the pump and radiator into my Cooler Master Stacker case. What I have right now is Frankenbox, and I'd like to clean it up. Please, do tell.

—Frank Phillips

ASSOCIATE EDITOR DAVID MURPHY RESPONDS: In this grand ol' world, each computer chassis will be a little different than its peers—or a whole lot different. Suffice it to say, what works for our Cooler Master Cosmos case may or may not work in any other case on the market—it's just the nature of the beast.

That said, have you tried mounting your radiator on the exterior of your case and attaching the pump somewhere inside? It's not the most aesthetically pleasing solution, but it sure beats the type of "Frankenbox" you describe.

MAXIMUM PC GOES DIGITAL

I currently do a lot of traveling, which means I can't always carry all my Maximum PC *mags with me wherever I go. I also have a current subscription to another magazine that offers an online subscription. I absolutely love your magazine but would love it even more if you offered an online subscription. It doesn't matter whether I get the included CD or not. I just want to be able to read your mag online in PDF format wherever I am in the world.*

—A. Perez

EDITOR IN CHIEF WILL SMITH RESPONDS: Today's your lucky day. You can download a digital version of *Maximum PC* to save on your laptop and carry with you everywhere at http://tinyurl.com/273ktp. As soon as an issue is off newsstands, we post the full PDFs, so anyone can download them for free. MPC

LETTERS POLICY: ***MAXIMUM PC*** invites your thoughts and comments. Send them to **input@maximumpc.com.** Please include your full name, town, and telephone number, and limit your letter to 300 words. Letters may be edited for space and clarity. Due to the vast amount of e-mail we receive, we cannot personally respond to each letter.

COMING NEXT MONTH IN MAXIMUMPC'S

RATED A FOR AWESOME JANUARY ISSUE

OVERCLOCKERS HANDBOOK!

Stock clocks are for sissies! We'll show you how to ratchet up the speeds on today's CPUs and videocards—safely and reliably.

VISTA: EXTREME MAKEOVER EDITION!

PC enthusiasts deserve an OS they can be proud of—or at the very least, an OS they can live with! Vista can be that (we swear!) *if* you follow our complete guide to tweaking and optimizing the OS.

CASES COMETH

We invite a bunch of the latest PC enclosures into our Lab, stuff 'em full of parts, and then render verdicts to decide whether they're worthy of your sweet rig.

DAVID BROADWATER'S

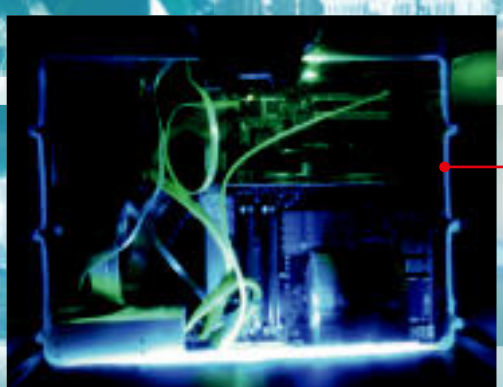
Fridge PC

The problem with computer gaming? You have to remain fully caffeinated to retain your twitch reflexes, but stepping away from your rig just isn't an option sometimes.

Dave Broadwater's solution? The Fridge PC, which combines a fully functional wine-cooler fridge with a kick-ass gaming rig. Dave explains that his creation is "perfect for storing cool beverages while keeping the rig at a chill 14 C."

Nice work, Dave. Once you attach the Cheetos dispenser, you'll never have to get out of your chair!

Errant moisture spells death for electronic components. To keep his rig safe, Dave cut a piece of Plexiglas down to size and mounted it between the beverage colderator and the rig's innards. Clear caulking finishes the job.



Turn out the lights and the Fridge PC's custom blue and green lighting scheme shines through.

What's a fridge without room for tasty drinks? To maximize storage space, David extended the back of the fridge with a custom galvanized steel plate and used a Dremel to cut a hole for the side-mounted CD-ROM drive.

To make room for the rig's components, David relocated the fridge's original cooling system to the top of the unit.

For his winning entry, David wins a $500 gift certificate for Buy.com to fund his modding madness! See all the hardware deals at www.buy.com, and turn to page 140 for contest rules.

MAXIMUM PC (ISSN 1522-4279) is published monthly by Future US, Inc, 4000 Shoreline Court, Suite 400, South San Francisco, CA 94080, USA. Periodicals postage paid in South San Francisco, CA, and at additional mailing offices. Newsstand distribution is handled by Curtis Circulation Company. Basic subscription rates: one year (13 issues) US: $20; Canada: $26; Foreign: $42. Basic subscription rates "Deluxe" version (w/CD): one year (13 issues/13 CD-ROMs) U.S.: $30; Canada: $40; Foreign $56. US funds only. Canadian price includes postage and GST (GST#R128220688). Postmaster: Send changes of address to Maximum PC, P.O. Box 5159, Harlan, IA 51593-0659. Standard Mail enclosed in the following editions: B1, C1, C2, C3, C4. N. Ride-Along enclosed in the following editions: D1, D2, D3, D4. Int'l Pub Mail# 0781029. Canada Post Publications Mail Agreement #40043631. Returns: Bleuchip International, P.O. Box 25542 London, ON N6C 6B2. For customer service, write Maximum PC, P.O. Box 5159, Harlan, IA 51593-0659; Maximum PC, 4000 Shoreline Court, Suite 400, South San Francisco, CA 94080. Future Network USA also publishes PC Gamer, PSM, MacLife, and Official Xbox. Entire contents copyright 2007, Future Network USA. All rights reserved. Reproduction in whole or in part is prohibited. Future Network USA is not affiliated with the companies or products covered in Maximum PC. PRODUCED AND PRINTED IN THE UNITED STATES OF AMERICA.